Measurement and analysis of capital, productivity and economic growth

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Appendices

Appendix 2.1: Derivation of Initial Capital stock

Consider the simple PIM in equation (2.1) (for simplicity, we skip the asset specific subscripts):

$$K_t = K_{t-1}(1-\delta) + I_t \quad \text{(A 1)}$$

Assuming that the country is on a steady state continuously with a constant capital output ratio, we have

$$\frac{\partial K_t}{K_{t-1}} = \frac{\partial Y_t}{Y_{t-1}} \quad \text{(A 2)}$$

From (A1), $\partial K_t = I_t - \delta K_{t-1}$, and therefore,

$$\frac{\partial K_t}{K_{t-1}} = \frac{I_t - \delta K_{t-1}}{K_{t-1}} = \frac{I_t}{K_{t-1}} - \delta \quad \text{(A 3)}$$

Also, from (A2), the output growth (g_t) can be equated with (A3), i.e.

$$g_t = \frac{\partial Y_t}{Y_{t-1}} = \frac{I_t}{K_{t-1}} - \delta \quad \text{(A 4)}$$

Now, introducing asset subscripts i and defining the investment rate for asset i as I_i / Y, the initial capital output ratio can be derived as,

$$\theta_i = \frac{(I_i / Y)}{(\delta_i + g)} \quad \text{(A 5)}$$

Appendix Table 2.1: List of countries and their World Bank income codes

Country	*Code*	*Country*	*Code*	*Country*	*Code*
Afghanistan	1	Germany*	4	Nigeria*	1
Albania	2	Ghana*	1	Norway*	4
Algeria	2	Greece*	4	Oman	3
Argentina*	3	Grenada	3	Pakistan	1
Australia*	4	Guatemala*	2	Panama*	3
Austria*	4	Guinea	1	Papua New Guinea	1
Bahamas*	5	Guinea-Bissau	1	Paraguay*	2
Bahrain	5	Haiti	1	Peru*	2
Bangladesh	1	Honduras*	2	Philippines*	2
Barbados	5	Hong Kong*	5	Poland	3
Belgium*	4	Hungary	3	Portugal*	4
Belize	3	Iceland*	4	Puerto Rico	5
Benin	1	India*	1	Qatar	5
Bhutan	2	Indonesia	2	Romania	3
Bolivia*	2	Iran*	2	Russia	3
Botswana*	3	Iraq	2	Rwanda	1
Brazil	3	Ireland*	4	Saudi Arabia	5
Brunei	5	Israel*	5	Senegal	1
Bulgaria	3	Italy*	4	Sierra Leone*	1
Burkina Faso	1	Jamaica	2	Singapore*	5
Burundi	1	Japan*	4	Slovak Republic	3
Cambodia	1	Jordan	2	Slovenia*	5
Cameroon	2	Kenya*	1	Solomon Islands	1
Canada*	4	Korea, Republic of*	4	Somalia	1
Cape Verde	2	Kuwait	5	South Africa	3
Central African Republic	1	Laos	1	Spain*	4
Chad	1	Lebanon	3	Sri Lanka*	2
Chile*	3	Lesotho	2	St.Vincent & Grenadines	3
China*	2	Liberia	1	Sudan	1
Colombia*	2	Luxembourg*	4	Suriname	2
Comoros	1	Macao	5	Swaziland	2
Congo, Republic of	2	Macedonia	2	Sweden*	4
Costa Rica	3	Madagascar	1	Switzerland*	4
Cote d`Ivoire	1	Malawi	1	Syria*	2
Croatia	3	Malaysia	3	Tanzania	1
Cuba	2	Maldives	2	Thailand*	2
Cyprus	5	Mali	1	Togo	1
Czech Republic*	4	Malta	5	Trinidad &Tobago	5
Denmark*	4	Mauritania	1	Tunisia	2
Dominica	3	Mauritius*	3	Turkey*	3
Dominican Republic*	2	Mexico*	3	Uganda	1
Ecuador*	2	Mongolia	1	United Arab Emirates	5
Egypt	2	Morocco	2	United Kingdom*	4
El Salvador	2	Mozambique	1	United States*	4
Equatorial Guinea	3	Namibia	2	Uruguay	3
Estonia	5	Nepal	1	Uzbekistan	1
Fiji	2	Netherlands*	4	Venezuela*	3
Finland*	4	Netherlands Antilles	5	Vietnam	1
France*	4	New Zealand*	4	Yemen	1
Gabon	3	Nicaragua	2	Zambia*	1
Gambia, The	1	Niger	1	Zimbabwe*	1

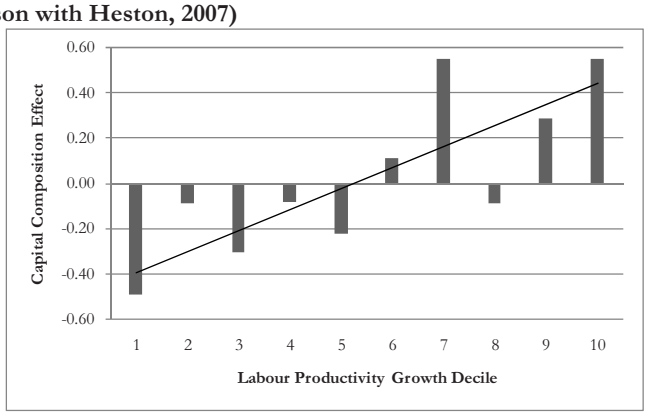
Notes: The codes are 1=Low income; 2=Lower Middle Income; 3=Upper Middle Income; 4=High Income OECD; and 5= High Income Non OECD. Countries with a * are those for which we had asset wise investment deflators. For other countries aggregate investment deflators are used.

Appendix Table 2.2: Country specific average real rate of return (%), 1980-2003

Country	Rate of return	Country	Rate of return	Country	Rate of return
Albania	6.66	Greece	1.16	Norway	4.28
Australia	4.60	Grenada	2.21	Pakistan	1.66
Bahamas	0.44	Honduras	0.63	Papua New Guinea	3.90
Bahrain	4.75	Hong Kong	1.04	Philippines	4.29
Barbados	1.86	Hungary	2.12	Poland	1.65
Belgium	4.55	Iceland	3.17	Singapore	0.52
Belize	3.04	Italy	3.94	Slovenia	1.84
Bolivia	9.17	Jamaica	2.11	Solomon Islands	0.05
Botswana	1.27	Japan	2.96	South Africa	2.44
Brazil	11.30	Kenya	2.44	Spain	3.67
Canada	4.46	Korea, Republic of	6.77	Sri Lanka	2.56
Cyprus	0.85	Kuwait	3.16	St.Vincent & Grenadines	2.82
Czech Republic	1.22	Lesotho	1.29	Sweden	3.82
Denmark	5.44	Madagascar	8.25	Switzerland	1.57
Dominica	2.43	Malaysia	1.72	Tanzania	1.80
Egypt	4.50	Malta	2.18	Thailand	4.49
Fiji	0.46	Mozambique	8.66	Trinidad &Tobago	0.02
Finland	4.66	Netherlands	4.05	United Kingdom	3.62
France	4.09	Netherlands Antilles	4.90	United States	3.13
Germany	2.70	New Zealand	3.94	Vietnam	4.46

Notes: Average of bond and treasury rates. Real rates are derived as nominal rate minus inflation rate. For those countries where the real rate is negative we use a rate of return of 4 %. A negative real rate of return would indicate that the long-term nominal interest rate is lower than long-term inflation rate.
Source: calculated using IMF IFS data.

Appendix Figure 2.1: capital services vs. capital stocks — The Composition effect, 1970-2000 (comparison with Heston, 2007)



Note: Composition Effect is calculated as compound growth rate of capital services during 1970-2000 using our new estimates minus compound growth rate of capital stock calculated from Heston (2007).

Appendix Table 3.1: Percentage of negative values in rental prices, industry wise

	INR	INRTX	INRS	INRSTX	IOR	IORTX
Netherlands						
17-19	2.0	2.0	2.0	2.0	2.0	2.0
20	-	-	-	-	-	0.7
23	2.0	3.3	0.7	2.0	0.7	2.0
25	1.3	3.3	2.0	2.7	1.3	3.3
30-33	3.3	4.7	4.0	4.7	3.3	4.7
34-35	4.7	8.7	4.7	8.7	5.3	7.3
Total	***0.5***	***0.8***	***0.5***	***0.8***	***0.5***	***0.8***
France						
10-14	13.3	15.3	12.7	13.3	12.7	13.3
17-19	-	2.0	-	2.0	-	-
20	3.3	3.3	3.3	3.3	2.7	3.3
23	0.7	0.7	0.7	0.7	0.7	0.7
26	4.7	4.7	4.7	4.7	4.7	4.7
27-28	2.7	3.3	2.7	3.3	2.7	3.3
30-33	0.7	2.0	-	2.7	-	-
34-35	6.7	8.0	6.7	8.0	5.3	6.7
40-41	-	0.7	-	-	-	-
Total	***1.2***	***1.5***	***1.2***	***1.5***	***1.1***	***1.2***
Germany						
01-05	10.0	12.0	9.3	12.0	9.3	13.3
10-14	8.0	21.3	8.7	21.3	6.7	22.0
17-19	-	-	-	0.7	-	-
20	-	1.3	-	1.3	-	1.3
23	3.3	5.3	3.3	5.3	3.3	5.3
27-28	-	0.7	-	1.3	-	-
30-33	-	0.7	-	1.3	-	2.0
34-35	1.3	2.7	1.3	2.7	0.7	2.0
36-37	-	1.3	-	2.0	-	0.7
52	0.7	1.3	0.7	1.3	-	1.3
55	2.0	10.0	2.7	9.3	2.7	8.7
60-63	4.7	8.0	2.7	9.3	2.7	12.0
Total	***1.2***	***2.5***	***1.1***	***2.6***	***1.0***	***2.6***

	INR	INRTX	INRS	INRSTX	IOR	IORTX
United Kingdom						
01-05	1.3	2.0	-	-	-	-
10-14	2.0	2.0	1.3	1.3	-	-
20	-	1.3	-	-	-	-
21-22	3.3	4.0	2.7	3.3	2.7	2.7
23	6.7	8.0	4.7	5.3	3.3	4.0
24	2.0	2.0	0.7	1.3	-	-
25	2.7	2.7	2.7	2.7	1.3	2.0
27-28	6.0	6.0	4.7	5.3	4.0	4.7
30-33	2.0	2.7	-	0.7	-	-
34-35	9.3	12.7	6.7	9.3	7.3	8.0
40-41	-	0.7	-	-	-	-
52	-	1.3	-	-	-	-
55	0.7	1.3	-	-	-	-
60-63	6.0	7.3	1.3	1.3	-	-
64	3.3	5.3	0.7	3.3	-	1.3
71-74	2.0	2.0	-	-	-	-
90-99	0.7	0.7	-	-	-	-
75-85	2.7	3.3	-	0.7	-	-
Total	***1.9***	***2.5***	***1.0***	***1.3***	***0.7***	***0.9***
United States						
10-14	0.7	4.0	-	-	-	-
20	-	0.7	-	0.7	-	-
21-22	-	0.7	-	-	-	-
26	0.7	0.7	0.7	0.7	0.7	0.7
30-33	0.7	2.0	-	2.7	-	0.7
34-35	1.3	1.3	1.3	1.3	1.3	1.3
45	0.7	1.3	-	-	-	0.7
60-63	-	1.3	-	1.3	-	-
90-99	2.0	4.0	2.7	2.7	2.0	2.7
Total	***0.2***	***0.6***	***0.2***	***0.4***	***0.2***	***0.2***

Note: ' - ' indicates the absence of negative rental price.

Appendix Table 3.2: Composition effect on MFPG, industry wise, 1979-2003

	Netherlands			France			Germany			UK			US		
ISIC	***INR***	***IOR***	***CER***	***INR***	***IOR***	***CER***	***INR***	***IOR***	***CER***	***INR***	***IOR***	***CER***	***INR***	***IOR***	***CER***
01-05	0.19	0.19	0.32	-0.03	-0.03	-0.07	0.16	0.17	0.11	0.06	0.06	0.04	0.03	0.07	0.10
10-14	-0.01	-0.01	-0.12	-0.13	-0.10	-0.06	-0.02	-0.01	0.00	0.15	0.09	0.39	-0.27	-0.08	-0.05
15-16	-0.10	-0.09	-0.18	-0.13	-0.10	-0.14	0.00	0.02	0.03	-0.13	-0.06	-0.09	-0.15	-0.08	-0.30
17-19	-0.09	-0.07	-0.11	-0.03	-0.02	-0.06	0.05	0.05	0.06	-0.07	-0.02	-0.05	-0.08	-0.04	-0.11
20	-0.10	-0.09	-0.14	-0.03	-0.02	-0.05	0.01	0.02	0.03	-0.03	0.08	0.08	-0.14	-0.06	-0.15
21-22	-0.15	-0.14	-0.25	-0.10	-0.07	-0.13	-0.04	-0.02	-0.05	-0.10	-0.03	-0.08	-0.20	-0.10	-0.27
23	-0.06	-0.07	-0.09	-0.09	-0.06	-0.11	0.18	0.12	0.21	0.18	0.23	0.21	-0.36	-0.22	-0.39
24	-0.09	-0.08	-0.17	-0.20	-0.15	-0.28	-0.07	-0.06	-0.11	-0.14	-0.04	-0.06	-0.30	-0.16	-0.56
25	-0.07	-0.06	-0.07	-0.09	-0.08	-0.22	-0.03	-0.02	-0.04	-0.11	-0.04	-0.07	-0.07	-0.04	-0.13
26	-0.09	-0.08	-0.19	-0.11	-0.08	-0.15	0.05	0.06	0.08	-0.11	0.01	-0.16	-0.19	-0.07	-0.24
27-28	-0.17	-0.16	-0.27	-0.07	-0.05	-0.07	0.02	0.02	0.03	-0.07	-0.02	-0.03	-0.20	-0.12	-0.22
29	-0.19	-0.17	-0.28	-0.06	-0.05	-0.10	-0.02	-0.01	-0.03	-0.08	0.00	-0.06	-0.17	-0.10	-0.37
30-33	-0.33	-0.32	-0.30	-0.08	-0.06	-0.09	-0.05	-0.04	-0.04	-0.10	0.01	-0.09	-0.38	-0.25	-0.41
34-35	-0.17	-0.21	-0.08	-0.22	-0.17	-0.19	-0.08	-0.08	-0.10	-0.15	-0.08	-0.03	-0.30	-0.19	-0.27
36-37	-0.05	-0.04	-0.07	-0.02	-0.01	-0.04	-0.03	-0.02	-0.02	-0.02	0.01	-0.10	-0.13	-0.07	-0.19
40-41	-0.17	-0.15	-0.17	-0.28	-0.11	-0.10	0.26	0.30	0.33	-0.07	0.04	0.06	-0.51	-0.39	-0.45
45	-0.02	-0.01	-0.04	0.00	0.01	0.03	0.04	0.05	0.12	-0.01	0.00	0.04	-0.08	-0.04	-0.09
50-51	-0.10	-0.09	-0.27	-0.06	-0.04	-0.17	0.03	0.05	0.09	-0.01	0.10	-0.06	-0.06	-0.01	-0.33
52	-0.06	-0.05	-0.14	-0.15	-0.11	-0.19	-0.01	0.00	0.02	-0.10	0.05	0.07	-0.27	-0.15	-0.19
55	-0.05	-0.04	-0.13	-0.11	-0.08	-0.07	0.10	0.11	0.10	-0.06	-0.03	-0.09	-0.07	-0.03	-0.04
60-63	0.11	0.09	0.09	-0.06	0.01	0.00	0.17	0.25	0.10	0.00	0.15	0.14	-0.18	-0.03	-0.04
64	-0.27	-0.26	-0.44	-0.20	-0.09	-0.11	-0.32	-0.32	-0.43	-0.61	-0.02	-0.05	-0.36	-0.18	-0.62
65-67	-0.24	-0.23	-0.47	-0.37	-0.25	-0.65	-0.17	-0.15	-0.35	-0.51	-0.26	-1.00	-0.22	-0.03	-0.82
71-74	-0.10	-0.10	-0.31	-0.12	-0.10	-0.38	-0.03	-0.02	0.04	-1.18	-0.73	-0.58	-0.22	-0.16	-0.80
90-99	-0.15	-0.12	-0.10	-0.28	-0.21	-0.37	-0.02	-0.02	-0.04	-0.13	-0.05	-0.11	-0.02	0.09	0.04
75-85	-0.08	-0.07	-0.05	-0.11	-0.08	-0.08	0.04	0.06	0.04	-0.14	-0.08	-0.05	-0.32	-0.23	-0.15
Average	***-0.10***	***-0.09***	***-0.16***	***-0.12***	***-0.08***	***-0.15***	***0.01***	***0.02***	***0.01***	***-0.14***	***-0.02***	***-0.07***	***-0.20***	***-0.10***	***-0.27***
SD	***0.11***	***0.10***	***0.16***	***0.09***	***0.06***	***0.14***	***0.11***	***0.12***	***0.15***	***0.27***	***0.17***	***0.25***	***0.13***	***0.10***	***0.24***

Note: Figures are TFPG using capital service growth rates minus TFPG using capital stock growth rates (all in percentages)

Appendix 4.1 Description of Data on Capital stock and Discards

As mentioned in Chapter 4, the firm level data used for lifetime estimation are taken from two distinct surveys conducted by Statistics Netherlands (CBS) — the capital stock survey and the discard survey. The capital stock data were collected between 1993 and 2003 for manufacturing firms coming under the ISIC two-digit level. Each year one or more two-digit industries have been surveyed, and the same industry will be subjected to a second survey after five years. The information on existing capital stock, with vintage structure, is available for eight asset types:

1 Land and sites (only purchase and sale of sites)
2 Industrial buildings (offices, shops, etc)
3 Civil engineering works (including site improvements: roads, pipelines, etc)
4 External transport equipment (excavators, drudging machines, etc)
5 Internal means of transport (cranes, pulleys, etc)
6 Computers and associated equipment (computers, printers, etc)
7 Machinery and equipment
8 Other tangible fixed assets (furniture, freight containers, etc).

In the present analysis, we consider only asset types 4–7. We have further merged internal means of transport (5) with machinery and equipment (7), as the capital stock survey provides information on these assets together, though the discard survey provides them separately. As mentioned in the Chapter, the capital stock in year t - 1 is merged for each vintage to the discard in years t, t + 1 and t + 2. Prior to merging the two databases, we have deleted all firms reported more than once (for same asset, vintage and ownership type causing double counting and hence an exaggeration of actual data), i.e. firms with double reporting in both surveys. Appendix Tables 4.1 and 4.2 show the number of firms reported to various surveys on capital stock and discard respectively. It can be seen that the number of manufacturing firms reported to the capital stock survey is 1354 in the first round and 1108 in the second round. The number of firms varies from 10 (7) in the petroleum, coke & nuclear fuel industry to 247 (234) in the food processing industry in the first (second) round. As is evident from Appendix Table 4.2, the number of manufacturing firms reported to various discard surveys during 1993–2001 varies over the years, the highest response rate being in 1997 and the lowest in 1996. As was observed in the capital stock survey, the largest number of firms reported is found to be in the food processing industry throughout the period, while the lowest number is observed in the petroleum, coke & nuclear fuel industry. Note that all the firms reported in these tables are not considered in our final sample, as we had to apply a number of cleansing rules to clean up the data, which resulted in elimination of a number of firms from the sample (see the discussion in the Chapter).

Appendix Table 4.1: Number of firms reported to two benchmark capital stock surveys

	First Round		Second Round	
	Survey	*No. of*	*Survey*	*No. of*
Industry	*Year*	*Firms*	*Year*	*Firms*
15+16	1993	247	1998	234
17 to19	1994	73	1999	54
20+33+36	1994	83	1999	94
21	1995	68	2000	77
22	1997	107	NA	NA
23	1994	10	1999	7
24	1997	144	NA	NA
25	1996	68	2001	77
26	1996	66	2001	67
27	1994	40	1999	37
28	1995	151	2000	153
29	1996	167	2001	172
30+32	1994	21	1999	21
31	1994	36	1999	37
34+35	1995	73	2000	78
Total		***1354***		
Total*		***1103***		***1108***

Notes: *Excludes industries 22 and 24 for which the second round is not available. NA indicates data not available. Also, the table contains only manufacturing industries which are considered in the present study. The data are available for other industries such as crude petroleum and natural gas production (11), other mining and quarrying (14), electricity, gas and water supply (40), collection, purification and distribution of water (41), and other business activities, such as legal and economic activities, architectural and engineering activities, advertising, activities of employment agencies and other business activities (74). The number of firms increases to 1379 (1128) and 1150 (1127) respectively in the first and second rounds, if we include these industries; the figures in parentheses indicate that the same industries are considered in both, while others include different industries in each round, for example 22 and 24 in the first round and 40, 41 and 74 in the second round.

Appendix Table 4. 2: Number of firms reported to various discard surveys

Industry	1994	1995	1996	1997	1998	1999	2000	2001
15+16	199	208	190	229	234	189	191	179
17to19	59	48	42	50	49	52	41	34
20+33+36	81	67	66	81	86	93	91	86
21	55	66	55	62	73	62	77	69
22	111	100	90	103	100	87	84	85
23	10	10	10	10	10	7	8	6
24	116	106	108	140	132	127	134	121
25	59	60	61	69	63	62	62	77
26	44	50	62	70	66	59	59	65
27	38	33	30	34	32	36	32	31
28	113	133	97	137	133	123	155	116
29	142	128	163	147	147	130	138	172
30+32	19	14	10	15	16	21	18	22
31	36	28	29	33	34	36	35	31
34+35	51	64	54	65	69	61	79	57
Total	***1133***	***1115***	***1067***	***1245***	***1244***	***1145***	***1204***	***1151***

Notes: In the last two years data is available on industries 11, 14 and 40 also, nevertheless, they are not included here. If they are included, the number of firms in 2000 increases to 1281 and in 2001 to 1211.

Appendix Table 4.3: Share of second-hand investment in total investment (%)

Industry	Transport Equpt.	Computer	Machinery
15+16	3.0	0.1	0.5
17to19	1.5	0.0	0.2
20+33+36	2.5	0.4	2.8
21	2.6	0.0	0.3
22	0.6	0.2	1.8
23	0.2	0.0	0.0
24	0.3	0.3	0.1
25	1.1	0.3	4.2
26	0.7	3.9	0.3
27	0.9	0.0	0.0
28	1.0	0.0	0.0
29	1.9	0.2	0.7
30+32	0.0	0.0	0.0
31	4.0	0.0	0.0
34+35	2.6	0.0	0.0
Total	***1.5***	***0.3***	***0.4***

Source: Investment survey, 2000, Statistics Netherlands

Appendix Table 4.4: Estimated regression coefficients -Transport equipments (single year discard)

	α				λ					
Industry	Estimate	SE	LC	UC	Estimate	SE	LC	UC	R^2	DF
15+16	1.169	0.031	1.105	1.233	0.117	0.002	0.113	0.120	0.994	23
17 to19	1.125	0.095	0.922	1.329	0.197	0.009	0.176	0.217	0.963	14
20+33+36	1.000	0.132	0.715	1.285	0.165	0.012	0.138	0.192	0.899	14
21	1.082	0.077	0.912	1.252	0.184	0.007	0.168	0.200	0.977	13
22	1.821	0.181	1.439	2.203	0.218	0.008	0.200	0.235	0.971	17
23	1.309	0.094	1.113	1.504	0.121	0.004	0.112	0.130	0.965	23
24	1.000	0.174	0.634	1.366	0.050	0.006	0.038	0.062	0.535	19
25	1.000	0.119	0.746	1.254	0.118	0.008	0.101	0.135	0.887	17
26	1.000	0.104	0.779	1.221	0.093	0.005	0.082	0.103	0.900	18
27	2.544	0.172	2.179	2.910	0.121	0.002	0.116	0.125	0.988	15
28	1.211	0.063	1.075	1.346	0.125	0.003	0.119	0.132	0.984	16
29	1.000	0.100	0.784	1.216	0.132	0.007	0.117	0.147	0.937	15
30+32	2.919	0.282	2.324	3.514	0.310	0.007	0.294	0.325	0.985	12
31	1.201	0.094	0.989	1.414	0.204	0.008	0.186	0.223	0.976	9
34+35	1.000	0.146	0.682	1.318	0.053	0.006	0.040	0.066	0.800	14

Notess: SE is the standard error of estimate. LC and UC are respectively lower and upper confidence interval at 95 % and DF is the degrees of freedom.

Appendix Table 4.5: Estimated regression coefficients – Computers (single year discard)

	α				λ					
Industry	Estimate	SE	LC	UC	Estimate	SE	LC	UC	R^2	DF
15+16	1.416	0.087	1.230	1.603	0.048	0.002	0.044	0.052	0.977	17
17 to19	1.071	0.160	0.713	1.428	0.036	0.007	0.022	0.051	0.910	12
20+33+36	1.926	0.186	1.529	2.322	0.065	0.002	0.060	0.070	0.953	16
21	1.914	0.268	1.331	2.498	0.071	0.004	0.062	0.080	0.910	14
22	1.000	0.079	0.830	1.170	0.060	0.003	0.053	0.066	0.954	16
23	1.889	0.368	1.100	2.678	0.054	0.005	0.044	0.065	0.766	16
24	1.055	0.049	0.952	1.159	0.035	0.002	0.032	0.038	0.983	18
25	1.798	0.190	1.380	2.216	0.037	0.004	0.029	0.045	0.957	13
26	1.415	0.090	1.221	1.609	0.038	0.002	0.034	0.043	0.979	15
27	3.724	0.244	3.215	4.233	0.052	0.001	0.050	0.053	0.977	22
28	2.073	0.082	1.900	2.246	0.099	0.001	0.096	0.101	0.994	18
29	1.757	0.122	1.494	2.019	0.065	0.002	0.061	0.069	0.974	16
30+32	1.492	0.064	1.357	1.628	0.133	0.003	0.128	0.139	0.991	19
31	1.207	0.158	0.855	1.559	0.035	0.006	0.023	0.047	0.933	12
34+35	2.747	0.210	2.293	3.200	0.091	0.002	0.087	0.094	0.980	15

Notes: As in Appendix Table 4.4.

Appendix Table 4.6: Estimated regression coefficients – Machinery (single year discard)

	α				λ					
Industry	Estimate	SE	LC	UC	Estimate	SE	LC	UC	R^2	DF
15+16	1.234	0.024	1.186	1.282	0.030	0.000	0.029	0.030	0.992	52
17 to19	1.690	0.048	1.593	1.786	0.031	0.000	0.031	0.032	0.989	44
20+33+36	1.000	0.041	0.917	1.083	0.029	0.001	0.028	0.030	0.961	47
21	1.000	0.092	0.814	1.186	0.019	0.001	0.016	0.022	0.680	39
22	1.316	0.067	1.179	1.453	0.041	0.001	0.039	0.043	0.970	29
23	2.354	0.066	2.222	2.485	0.015	0.000	0.014	0.015	0.984	50
24	2.130	0.076	1.977	2.283	0.030	0.000	0.029	0.030	0.982	48
25	1.331	0.026	1.279	1.382	0.026	0.000	0.026	0.027	0.993	43
26	1.252	0.076	1.099	1.405	0.026	0.001	0.025	0.028	0.934	46
27	1.554	0.082	1.389	1.720	0.017	0.001	0.016	0.018	0.944	50
28	1.574	0.060	1.454	1.693	0.032	0.000	0.031	0.032	0.973	62
29	1.046	0.040	0.965	1.127	0.040	0.001	0.039	0.042	0.969	47
30+32	1.494	0.023	1.447	1.540	0.066	0.000	0.065	0.067	0.997	59
31	1.701	0.106	1.487	1.915	0.031	0.001	0.030	0.032	0.941	53
34+35	1.425	0.094	1.237	1.614	0.023	0.001	0.021	0.024	0.909	54

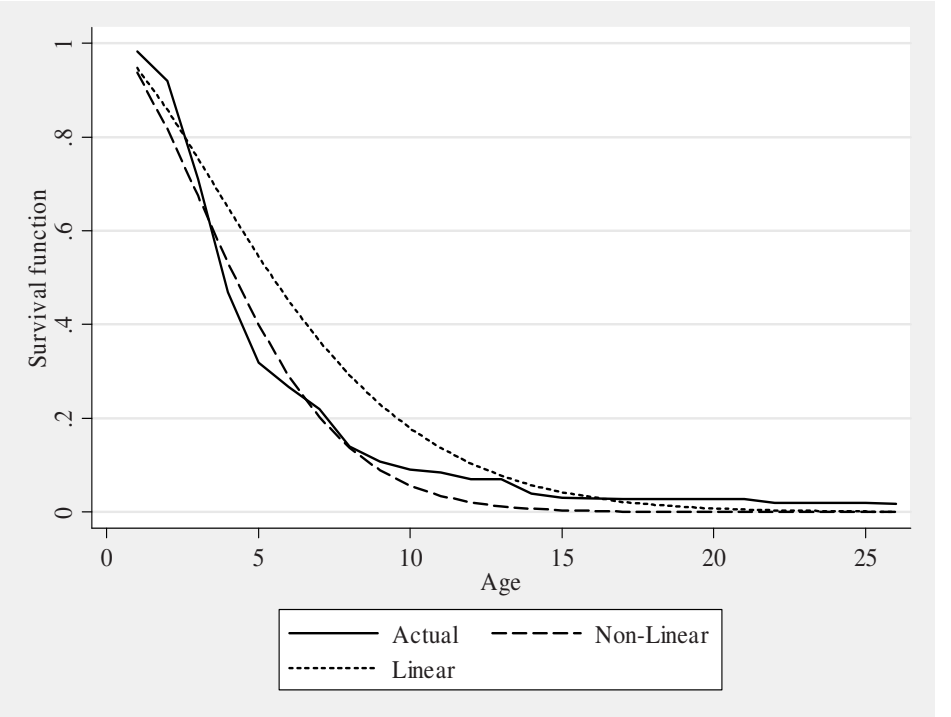
Notes: As in Appendix Table 4.4.

Appendix Table 4.7: Destination of discard — share of different destinations in total asset discards, 2000

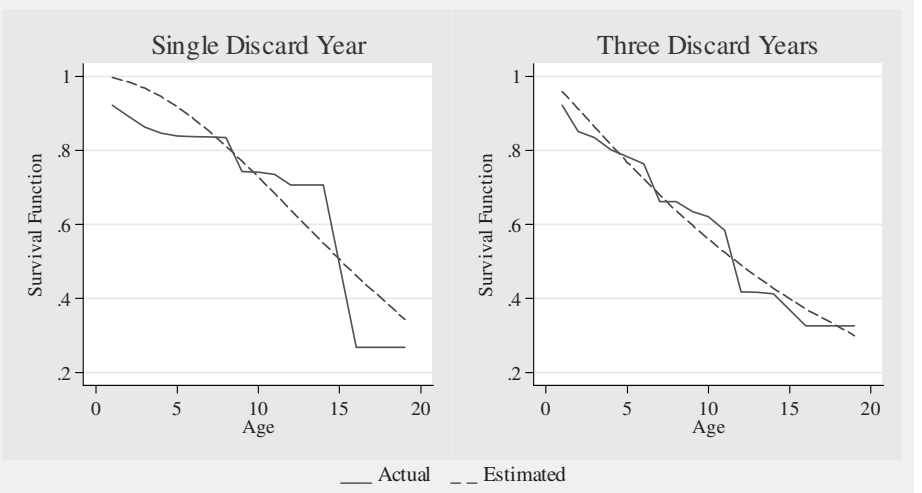
	Transport Equipment				Computers				Machinery			
Industry	*Scrap*	*2nd hand Sale*	*Unknown*	*Return to lease company*	*Scrap*	*2nd hand Sale*	*Unknown*	*Return to lease company*	*Scrap*	*2nd hand Sale*	*Unknown*	*Return to lease company*
15+16	4.1	67.1	18.8	10.1	73.4	7.7	18.9	0.0	35.9	35.4	27.9	0.7
17+18+19	0.0	42.8	0.4	56.8	28.7	0.6	70.7	0.0	56.2	33.0	10.8	0.0
20+33+36	1.4	52.8	12.0	33.7	81.3	12.5	5.6	0.5	59.9	12.9	26.9	0.2
21	0.7	23.9	0.1	75.4	95.2	3.9	0.9	0.0	33.7	57.5	3.5	5.3
22	0.1	40.9	20.0	39.0	39.3	19.8	37.8	3.0	10.5	64.7	15.8	9.0
23	9.8	9.6	7.1	73.5	72.0	3.3	24.7	0.0	95.0	0.1	4.9	0.0
24	26.7	21.9	4.0	47.5	34.8	3.6	59.2	2.4	41.1	1.2	57.7	0.0
25	4.0	29.2	0.0	66.8	62.2	7.0	30.8	0.0	37.3	25.5	37.0	0.1
26	0.3	90.4	2.1	7.2	22.4	0.2	77.4	0.0	71.2	12.2	15.8	0.8
27	14.2	48.7	3.9	33.2	28.1	12.4	59.6	0.0	23.4	70.8	5.7	0.0
28	0.6	52.4	1.2	45.9	32.5	11.5	52.4	3.5	16.8	25.3	56.1	1.8
29	0.5	33.1	9.0	57.4	36.1	28.9	35.0	0.0	46.1	43.1	10.8	0.0
30+32	0.8	4.7	0.2	94.3	85.7	1.9	12.4	0.0	56.2	37.4	5.3	1.1
31	0.0	1.9	0.1	98.0	34.1	2.6	63.3	0.0	23.8	63.6	12.6	0.0
34+35	0.0	25.7	0.5	73.8	8.2	86.4	0.1	5.3	82.8	15.3	0.2	1.6
Total	***2.5***	***34.7***	***6.4***	***56.4***	***52.64***	***16.66***	***29.15***	***1.5***	***52.47***	***13.29***	***33.56***	***0.68***
Average	***4.2***	***36.3***	***5.3***	***54.2***	***48.9***	***13.5***	***36.6***	***1.0***	***46.0***	***33.2***	***19.4***	***1.4***
Maximum	***26.7***	***90.4***	***20.0***	***98.0***	***95.2***	***86.4***	***77.4***	***5.3***	***95.0***	***70.8***	***57.7***	***9.0***
Minimum	***0.0***	***1.9***	***0.0***	***7.2***	***8.2***	***0.2***	***0.1***	***0.0***	***10.5***	***0.1***	***0.2***	***0.0***

Note: The values are current price shares of each type of discarded capital in total discard of the asset concerned.

Appendix Figure 4.1: Linear vs. non-linear estimation of survival function, transport equipment in industry printing and publishing



Appendix figure 4.2: Actual vs. estimated survival function using single year and three years discard information, computers in industry petroleum, cokes and nuclear fuel



Appendix 5.1: Linking different surveys

In addition to the capital stock and discard surveys, discussed in Chapter 4 and in Appendix 4.1, the CBS also provide establishment data collected through three other different surveys: the production survey (PS), the investment survey (IS), and the community innovation survey (CiS). In order to construct a combined dataset that is used in our analysis of discard behaviour (Chapter 5), it was essential to link these three surveys to capital stock and discard surveys at firm level. In what follows we discuss these three surveys and the procedure used to link them to a common database. Descriptions of capital stock and discard surveys are provided in Appendix 4.1.

Production Survey is conducted every year for all the firms in the Netherlands, basically on variables associated with profit and loss account. The survey provides data on employment (in numbers), materials, depreciation, investment, sales, export, energy, costs, output, taxes and subsidies, wages, profits and so on.[1] The data has been classified under Dutch industry classification, for each firm/company (establishment). Also the data is classified by size of employment class. In the present study we utilize data on output, wages and employment for manufacturing firms employing 100 or more employees during the period 1998-2000.

Investment Survey is also conducted every year. All firms employing more than 20 employees are covered in the sample. Moreover, for enterprises with less than 20 employees a random sample is drawn for survey. The survey provides asset wise information on investment variables for each enterprise. In our description of the production survey, we mentioned that it provides data on investment. Nevertheless, the investment data in investment survey is arguably better than the ones available in production survey. This is because this data has been crosschecked for missing data and extreme values. Hence the final dataset available at the lab is confirmed by the relevant firm, and is hence more accurate. The survey follows almost similar structure in all the years, though there are minor changes. The data is available under 6 digit industry classification, for different asset types, which are strictly comparable with the capital stock surveys (see discussion in the previous chapter). We use the investment series for manufacturing firms employing 100 or more workers during the period 1994-2001, in order to construct a series of capital stock, for the three asset types, machinery, computers and transport equipment.

Innovation Survey has been conducted under various community surveys. These surveys are conducted on all firms (enterprises) in the manufacturing and service sectors in the Netherlands. The survey provides a myriad of information on innovation variables such as innovation investment, innovation output and qualitative variables associated with technological environment. The surveys are conducted for an interval of three years. While most qualitative information belongs to duration of this interval, the information on quantitative variables such as R&D expenditure are collected for the last year of the survey. We use the CiS3 which covers the period 1998-2000.

Linking capital stock and Discard: Construction of Capital Stock Series

In order to construct discard rates, output growth, wage rate growth, and innovation indicators for each firm, we have linked the above three databases to capital and discard databases. Since the capital stock survey was a rolling survey, conducted for each industry once in five years since 1993, we did not had information across years, and therefore, it was essential to construct capital

[1] All the values prior to 2000 are in 1000 Guilders and afterwards in 1000 Euros. Therefore, values prior to 2000 have been converted to Euros using the Guilder-Euro conversion factor, 2.20371.

stock for all firms for the relevant time period we are considering.[2] In doing this we have first linked various capital stock surveys available since 1993-2001 so that we have at least one benchmark year capital stock for each 2 digit industry. This capital stock data is subsequently linked to annual discard surveys during 1994-2001 for each firm, asset type and vintage year. These values are in historic prices; hence each vintage is converted to current prices using investment deflators. These figures are then aggregated across various vintages for each asset for each firm, under a given 2 digit industry classification. The current price values are then converted to constant 1995 prices.[3] This provides us a database that contains at least one benchmark capital stock for each industry at firm-level, and the corresponding discards for the period 1993-2001 in constant 1995 Euros. The annual investment surveys during 1994-2001 are then linked to the aggregated capital stock and discard data for each firm and asset type. The definitions used in capital stock, discard and investment surveys are quite comparable.[4] Therefore, in principle, one should be able to arrive at a series of consistent capital stock, using a benchmark year capital stock (as available from capital stock survey) and the investment and discard data for subsequent years as:

$$K_{it} = K_{it-1} - D_{it} + I_{it} \qquad \text{(A 6)}$$

Then, the discard rates are calculated as discard in year t divided by capital stock in year t-1, averaged across 1998-2001, as explained in the Chapter.

Once the capital stock is constructed, this data has been linked to output and innovation surveys during 1997-2001for each firm. We have converted the current price output figures to constant 1995 pries using output deflators. We have dropped all those firms that have not reported to innovation survey, discard survey and/or capital survey. The final dataset contains only 459 large and medium sized manufacturing firms that have reported to discard, capital stock, investment, innovation and output surveys. This constitutes about 39 per cent of manufacturing firms employing 100 or more workers reported to capital stock and investment surveys, and 32 per cent of firms reported to production survey. From these 459 firms, we have selected the firms that had information for each asset types, which ended up in computer with 357 firms, machinery with 366 firms and transport equipment with 226 firms which are used in the final analysis.

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[2] While unearthing the contribution of innovation to productivity growth, linking innovation and production surveys, van Leeuwen and Klomp (2002) also make use of firm-level capital inputs for the Netherlands. However, they have proxied capital by the depreciation cost available in the production surveys. Our approach is better as we have used actual observed capital stock along with actual discards as reported by firms.

[3] While aggregating the data we have observed many firms repeatedly reported to capital stock and discard surveys, for the same vintage, same asset and with same values. We have identified all such firms and deleted them from the sample. However, there were some cases which have reported repeatedly, but with different values for historic capital and discards. This can happen due to lack of information on vintage year. In such cases, if there is some information on their vintage class (to the period in which their vintage refers to), we have attributed a mid point vintage year and included them in the sample. If no information on vintage class is available, we have dropped such firms. The number of such firms was, however, very low.

[4] Nevertheless, there are inconsistencies in the results. This has largely been due to the quality of individual enterprises response. For instance, for some vintages initial gross fixed capital formation is smaller than the values obtained from the observed capital stock (Meinen, 1998). This problem was mostly in construction capital, which we have not used in our analysis.

Appendix Table 5.1: Inter industry variation in average discard rates: Coefficient of variation (2 digit industries)

Asset	1999	2000	2001
Machinery	118.1	52.4	43.8
Computers	120.7	110.5	139.8
Transport Equipment	71.8	81.2	54.3

Appendix Table 5.2: Number of firms reported to investment, output and innovation surveys

Year/Period	Investment Survey	Output Survey	Innovation Survey (CiS3)
1997	1335	1192	
1998	1403	1143	
1999	1455	1052	
2000	1502	1014	
2001	1561	1095	
1998-00			1075
Final Sample	***459***	***459***	***459***

Note: for the number of firms reported to capital stock and discard surveys, see Appendix Table in Chapter 4. * Firms reported to capital stock, discard, investment, production and innovation surveys.

Appendix Table 5.3: Classification of manufacturing industries based on technology

	Industries	ISIC Rev. 3
High tech	**High-technology industries**	
	Aircraft and spacecraft	353
	Pharmaceuticals	2423
	Office, accounting and computing machinery	30
	Radio, TV and communciations equipment	32
	Medical, precision and optical instruments	33
	Medium-high-technology industries	
	Electrical machinery and apparatus, n.e.c.	31
	Motor vehicles, trailers and semi-trailers	34
	Chemicals excluding pharmaceuticals	24 excl. 2423
	Railroad equipment and transport equipment, n.e.c.	352 + 359
	Machinery and equipment, n.e.c.	29
Low tech	**Medium-low-technology industries**	
	Building and repairing of ships and boats	351
	Rubber and plastics products	25
	Coke, refined petroleum products and nuclear fuel	23
	Other non-metallic mineral products	26
	Basic metals and fabricated metal products	27-28
	Low-technology industries	
	Manufacturing, n.e.c.; Recycling	36-37
	Wood, pulp, paper, paper products, printing and publishing	20-22
	Food products, beverages and tobacco	15-16
	Textiles, textile products, leather and footwear	17-19

Source: OECD: ANBERD and STAN databases, May 2003, http://www1.oecd.org/ publications/e-book/ 92-2003-04-1-7294/annex-1.htm

Appendix Table 5.4: Correlation between explanatory variables

	YG	WG	AGE	INNOV	PDTIN	TURN	PCSIN	RDX
				Machinery				
WG	0.02							
AGE	0.01	0.04						
INNOV	0.01	0.03	0.05					
PDTIN	0.11	0.06	0.03	0.81				
TURN	0.15	0.14	-0.06	0.43	0.54			
PCSIN	0.02	0.05	0.05	0.64	0.44	0.24		
RDX	0.04	0.02	0.15	0.09	0.13	0.16	0.03	
RDN	0.09	0.08	0.07	0.20	0.23	0.32	0.06	0.56
				Transport				
WG	0.23							
AGE	-0.05	0.02						
INNOV	0.13	-0.01	-0.14					
PDTIN	0.16	0.07	-0.11	0.82				
TURN	0.21	0.15	-0.17	0.44	0.54			
PCSIN	0.16	-0.04	-0.03	0.68	0.49	0.32		
RDX	0.11	0.07	0.08	0.12	0.13	0.16	0.08	
RDN	0.21	0.11	0.00	0.20	0.22	0.26	0.12	0.63
				Computers				
WG	0.02							
AGE	-0.07	0.06						
INNOV	0.01	0.03	-0.02					
PDTIN	0.11	0.06	-0.01	0.81				
TURN	0.15	0.15	-0.02	0.43	0.54			
PCSIN	0.02	0.05	0.06	0.64	0.45	0.24		
RDX	0.04	0.02	0.08	0.09	0.13	0.16	0.02	
RDN	0.09	0.08	0.06	0.20	0.24	0.32	0.06	0.56

Note: WG is wage rate, INNOV is total innovation dummy, PDTIN is product-innovation dummy, TURN is turn over share due to product innovation, PCSIN is process-innovation dummy, RDX is extramural R&D intensity and RDIN is intramural R&D intensity.

Appendix Table 6.1: Hofstede dimensions for the countries in our sample

Country	PerCap. ICT exp.	PerCap. Computer	PD	ID	MA	UA	LTO	Income Dummy
Arab World	1	1	80	38	52	68	NA	1
Argentina	2	2	49	46	56	86	NA	1
Australia	3	3	36	90	61	51	31	1
Austria	4	4	11	55	79	70	NA	1
Bangladesh	NA	5	80	20	55	60	40	0
Belgium	5	6	65	75	54	94	NA	1
Brazil	6	7	69	38	49	76	65	0
Bulgaria	NA	8	70	30	40	85	NA	0
Canada	7	9	39	80	52	48	23	1
Chile	8	10	63	23	28	86	NA	1
China	9	11	80	20	66	40	118	0
Colombia	10	12	67	13	64	80	NA	0
Costa Rica	NA	13	35	15	21	86	NA	1
Czech Republic	NA	14	57	58	57	74	13	1
Denmark	11	15	18	74	16	23	NA	1
East Africa	12	NA	64	27	41	52	25	0
East Africa	NA	16	64	27	41	52	25	0
Ecuador	13	17	78	8	63	67	NA	0
Finland	14	18	33	63	26	59	NA	1
France	15	19	68	71	43	86	NA	1
Germany	16	20	35	67	66	65	31	1
Greece	17	21	60	35	57	112	NA	1
Guatemala	18	NA	95	6	37	101	NA	0
Hong Kong	19	22	68	25	57	29	96	1
Hungary	20	23	46	55	88	82	NA	1
India	21	24	77	48	56	40	61	0
Indonesia	22	25	78	14	46	48	NA	0
Iran	23	26	58	41	43	59	NA	0
Ireland	24	27	28	70	68	35	NA	1
Israel	25	28	13	54	47	81	NA	1
Italy	26	29	50	76	70	75	NA	1
Jamaica	NA	30	45	39	68	13	NA	0
Japan	27	31	54	46	95	92	80	1
Malaysia	28	32	104	26	50	36	NA	1
Mexico	29	33	81	30	69	82	NA	1
Netherlands	30	34	38	80	14	53	44	1
New Zealand	31	35	22	79	58	49	30	1
Norway	32	36	31	69	8	50	20	1
Pakistan	33	37	55	14	50	70	NA	0
Panama	NA	38	95	11	44	86	NA	1
Peru	34	39	64	16	42	87	NA	0
Philippines	35	40	94	32	64	44	19	1
Poland	36	41	68	60	64	93	NA	1
Portugal	37	42	63	27	31	104	NA	1
Romania	NA	43	90	30	42	90	NA	0
Singapore	38	44	74	20	48	8	48	1
Slovakia	NA	45	104	52	110	51	38	1
South Africa	39	46	49	65	63	49	NA	0
South Korea	40	NA	60	18	39	85	75	1
Spain	41	47	57	51	42	86	NA	1
Sweden	42	48	31	71	5	29	33	1
Switzerland	43	49	34	68	70	58	NA	1
Thailand	44	50	64	20	34	64	56	0
Turkey	45	51	66	37	45	85	NA	0
United Kingdom	46	52	35	89	66	35	25	1
United States	47	53	40	91	62	46	29	1
Uruguay	NA	54	61	36	38	100	NA	1
Venezuela	48	55	81	12	73	76	NA	1
West Africa	49	56	77	20	46	54	16	0

Source: http://www.geert-hofstede.com/hofstede_dimensions.php (accessed in June 2006).
Note: PD is power distance, UA is uncertainty avoidance, ID is individualism, MA is masculinity and LTO is long-term orientation. First two columns indicate whether the country had data on per capita ICT spending and/or per capita computer. Income Dummy = 1 for high-income countries.