



## **Online-Appendix zu**

„R&D accounting discretion as an income  
smoothing tool: An empirical analysis of  
German listed companies“

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## Appendix

### Appendix 1: Overview of variables (own table)

Type of variable	Name of variable	Calculation	Formula
Dependent	<i>R&amp;DCapitalization</i>	Total R&D capitalization divided by total assets	$R\&DCapitalization_t = \frac{R\&D\ capitalized_t}{Total\ assets_t}$
Independent	<i>ΔRoA</i>	Current year's pre-managed EBIT (without R&D capitalization) minus the average of the last two years' EBIT normalized by the current year's total assets before R&D capitalization	$\Delta RoA_t = \frac{(EBIT_t - R\&D\ capitalized_t) - \frac{EBIT_{t-1} + EBIT_{t-2}}{2}}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>Leverage</i>	Firm's total debt divided by total assets before R&D	$Leverage_t = \frac{Total\ debt_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>R&amp;DTotal</i>	Total amount of R&D expenditures undertaken by the firm divided by total assets in the current fiscal year before R&D	$R\&DTotal_t = \frac{Total\ R\&D\ expenditures_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>RoA</i>	EBIT before R&D capitalization divided by current total assets less capitalized R&D	$RoA_t = \frac{EBIT_t - R\&D\ capitalized_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>Size</i>	Natural logarithmic form of the firm's total assets before capitalized R&D	$Size_t = \ln(Total\ assets_t - R\&D\ capitalized_t)$
Control	<i>High-Capitalizer</i>	Dummy variable equal to one if the amount capitalized (normalized by the earnings) is above the median of sample firms	$High - Capitalizer_t = 1 \text{ if } \frac{R\&D\ capitalized_t}{EBIT_t} > Median \text{ of } \frac{R\&D\ capitalized_t}{EBIT_t}$ $High - Capitalizer_t = 0 \text{ if } \frac{R\&D\ capitalized_t}{EBIT_t} < Median \text{ of } \frac{R\&D\ capitalized_t}{EBIT_t}$
Control	<i>LagCapitalization</i>	Capitalization of the prior year	$LagCapitalization_t = R\&DCapitalization_{t-1} = \frac{R\&D\ capitalized_{t-1}}{Total\ assets_{t-1}}$
Control	<i>GrowthExpectation</i>	Market value of equity divided by its book value	$GrowthExpectation_t = \frac{Market\ capitalization_t}{Book\ value\ of\ equity_t}$
Control	<i>Growth</i>	Change in sales compared to prior year	$Growth_t = \frac{(Sales_t - Sales_{t-1})}{Sales_{t-1}}$
Control	<i>Year</i>	Year analyzed	<i>Year Dummies</i>
Control	<i>Industry</i>	Company's industry according to GICS	<i>Industry Dummies</i>

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Control	<i>Leverage</i>	Firm's total debt divided by total assets before R&D	$Leverage_t = \frac{Total\ debt_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>R&amp;DTotal</i>	Total amount of R&D expenditures undertaken by the firm divided by total assets in the current fiscal year before R&D	$R\&DTotal_t = \frac{Total\ R\&D\ expenditures_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>RoA</i>	EBIT before R&D capitalization divided by current total assets less capitalized R&D	$RoA_t = \frac{EBIT_t - R\&D\ capitalized_t}{Total\ assets_t - R\&D\ capitalized_t}$
Control	<i>Size</i>	Natural logarithmic form of the firm's total assets before capitalized R&D	$Size_t = \ln(Total\ assets_t - R\&D\ capitalized_t)$
Control	<i>High-Capitalizer</i>	Dummy variable equal to one if the amount capitalized (normalized by the earnings) is above the median of sample firms	$High - Capitalizer_t = 1 \text{ if } \frac{R\&D\ capitalized_t}{EBIT_t} > Median \text{ of } \frac{R\&D\ capitalized_t}{EBIT_t}$ $High - Capitalizer_t = 0 \text{ if } \frac{R\&D\ capitalized_t}{EBIT_t} < Median \text{ of } \frac{R\&D\ capitalized_t}{EBIT_t}$
Control	<i>LagCapitalization</i>	Capitalization of the prior year	$LagCapitalization_t = R\&DCapitalization_{t-1} = \frac{R\&D\ capitalized_{t-1}}{Total\ assets_{t-1}}$
Control	<i>GrowthExpectation</i>	Market value of equity divided by its book value	$GrowthExpectation_t = \frac{Market\ capitalization_t}{Book\ value\ of\ equity_t}$
Control	<i>Growth</i>	Change in sales compared to prior year	$Growth_t = \frac{(Sales_t - Sales_{t-1})}{Sales_{t-1}}$
Control	<i>Year</i>	Year analyzed	<i>Year Dummies</i>
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## Appendix 2: Bravais-Pearson correlation among variables by industry (own table)

Industry			RD Capitalization	RDTotal	Leverage	ROA	ARoA	Growth Expectation
<b>Industrials</b>	RDTotal	Pearson Correlation	0,766**					
	Leverage	Pearson Correlation	0,414	0,127				
	ROA	Pearson Correlation	-0,020	0,419	-0,589*			
	ARoA	Pearson Correlation	-0,007	0,323	-0,330	0,863**		
	GrowthExpectation	Pearson Correlation	0,029	0,446	-0,465	0,821**	0,811**	
	Growth	Pearson Correlation	0,456	0,496	0,039	0,394	0,548*	0,460
<b>Health care</b>	RDTotal	Pearson Correlation	0,812**					
	Leverage	Pearson Correlation	-0,780**	-0,876**				
	ROA	Pearson Correlation	0,501*	0,743**	-0,885**			
	ARoA	Pearson Correlation	-0,688**	-0,390	0,296	0,137		
	GrowthExpectation	Pearson Correlation	0,352	0,693**	-0,568*	0,666**	0,041	
	Growth	Pearson Correlation	-0,004	0,041	-0,194	0,125	-0,015	-0,070
<b>Consumer discretionary</b>	RDTotal	Pearson Correlation	-0,811**					
	Leverage	Pearson Correlation	0,835**	-0,971**				
	ROA	Pearson Correlation	-0,908**	0,838**	-0,893**			
	ARoA	Pearson Correlation	-0,689**	0,508*	-0,597*	0,814**		
	GrowthExpectation	Pearson Correlation	-0,930**	0,867**	-0,880**	0,956**	,689**	
	Growth	Pearson Correlation	-0,186	-0,022	-0,054	0,149	0,325	0,164
<b>Telecommunication services</b>	RDTotal	Pearson Correlation	0,996**					
	Leverage	Pearson Correlation	-0,988**	-0,992**				
	ROA	Pearson Correlation	-0,955**	-0,966**	0,951**			
	ARoA	Pearson Correlation	-0,898**	-0,920**	0,900**	0,983**		
	GrowthExpectation	Pearson Correlation	-0,339	-0,373	0,348	0,582	0,677	
	Growth	Pearson Correlation	0,451	0,385	-0,357	-0,226	-0,084	0,509
<b>Conglomerate</b>	RDTotal	Pearson Correlation	0,412					
	Leverage	Pearson Correlation	-0,877**	-0,089				
	ROA	Pearson Correlation	0,893**	0,303	-0,780*			
	ARoA	Pearson Correlation	0,306	0,033	-0,067	0,617		
	GrowthExpectation	Pearson Correlation	-0,781*	0,123	0,970**	-0,679	-0,003	
	Growth	Pearson Correlation	-0,037	-0,625	-0,119	0,188	0,536	-0,211
<b>Utilities</b>	RDTotal	Pearson Correlation	0,978**					
	Leverage	Pearson Correlation	-0,865**	-0,930**				
	ROA	Pearson Correlation	0,439	0,547	-0,688			
	ARoA	Pearson Correlation	0,773*	0,778*	-0,773*	0,794*		
	GrowthExpectation	Pearson Correlation	0,636	0,735*	-0,713*	0,687	0,520	
	Growth	Pearson Correlation	0,786*	0,862**	-0,943**	0,624	0,635	0,724*
<b>Materials</b>	RDTotal	Pearson Correlation	0,729**					
	Leverage	Pearson Correlation	0,332	0,750**				
	ROA	Pearson Correlation	0,485	0,620*	0,423			
	ARoA	Pearson Correlation	0,394	0,412	0,453	0,430		
	GrowthExpectation	Pearson Correlation	0,653*	0,849**	0,781**	0,302	0,525	
	Growth	Pearson Correlation	0,385	0,288	0,466	0,252	0,796**	0,554
<b>Information technology</b>	RDTotal	Pearson Correlation	0,600					
	Leverage	Pearson Correlation	0,976**	0,515				
	ROA	Pearson Correlation	-0,882**	-0,181	-0,895**			
	ARoA	Pearson Correlation	-0,949**	-0,619	-0,910**	0,833*		
	GrowthExpectation	Pearson Correlation	0,632	-0,086	0,730*	-0,812*	-0,468	
	Growth	Pearson Correlation	-0,180	-0,300	-0,027	0,062	0,351	0,287

\*\* . Correlation is significant at the 0.01 level (2-tailed).  
\* . Correlation is significant at the 0.05 level (2-tailed).

## Appendix 3: Comparison of this study to prior literature (own table)

	Markarian et al. (2008)	Persson & Fuentes (2011)	Halioui & Triki-Damak (2013)	Guidara & Boujelbene (2014)	Garanina et al. (2016)	Findings of this thesis
$\Delta$ RoA	-	- *	-	(-)	- **	-
RoA	-	+ *		+		-
Leverage	(-)	(+/-)	+	+	+ **	+
RDTotal	(+)	+ *		(+)	+	+
LagCapitalization	+				+ **	+
HighCapitalizer	+					(+)
Size	(-)	- *		(+)	+ **	-
Growth		- *				(+)
GrowthExpectation	+	(+/-)	(+)	(+)		(+)

-	significantly negative
+	significantly positive
(+)	insignificantly positive
(-)	insignificantly negative
	not considered in the analysis

\* observation over 3 different periods that show different results

\*\* observation across countries yield different results

## Appendix 4: ANOVA (own table)

	Sum of Squares	df	Mean Square	F	Sig.
<b>Regression</b>	0,078	19	0,004	40,163	0,000
<b>Residual</b>	0,007	72	0,000		
<b>Total</b>	0,085	91			

Appendix 5: Regression model using  $\Delta$ RoE and including *Manage* (own table)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,062	0,014		4,419	0,000	0,034	0,091
$\Delta$ RoE	-0,021 **	0,008	-0,143	-2,775	0,007	-0,036	-0,006
RoE	-0,026 **	0,010	-0,137	-2,532	0,014	-0,047	-0,006
Manage $\Delta$ RoE	0,007 *	0,003	0,103	2,252	0,027	0,001	0,014
Leverage	0,035 **	0,011	0,175	3,162	0,002	0,013	0,057
RDTotal	0,077 **	0,021	0,235	3,709	0,000	0,036	0,118
LagCapitalization	0,067 **	0,024	0,122	2,823	0,006	0,020	0,114
HighCapitalizer	-0,001	0,004	-0,018	-0,308	0,759	-0,008	0,006
Size	-0,007 **	0,001	-0,552	-6,717	0,000	-0,009	-0,005
Growth	-0,001	0,014	-0,002	-0,043	0,966	-0,028	0,027
GrowthExpectation	0,000	0,000	-0,045	-0,938	0,351	-0,001	0,000

The regression controls for years and industries

\*\*Significant at the 0.01 level / \*Significant at the 0.05 level

R = 0,953 / R Square = 0,907 / Adjusted R Square = 0,881 / Std. Error of the Estimate = 0,0105

Appendix 6: Regression model using  $\Delta RoE2$  and including *Manage* (own table)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,049	0,012		4,249	0,000	0,026	0,072
$\Delta RoE2$	-0,023**	0,007	-0,160	-3,379	0,001	-0,037	-0,009
RoE	-0,036**	0,010	-0,189	-3,515	0,001	-0,057	-0,016
Leverage	0,034**	0,011	0,172	3,073	0,003	0,012	0,056
RDTotal	0,076**	0,021	0,233	3,671	0,000	0,035	0,118
LagCapitalization	0,068**	0,024	0,124	2,814	0,006	0,020	0,116
HighCapitalizer	0,002	0,003	0,027	0,481	0,632	-0,005	0,008
Size	-0,007**	0,001	-0,533	-6,347	0,000	-0,009	-0,005
Growth	0,003	0,014	0,011	0,218	0,828	-0,025	0,031
GrowthExpectation	0,000	0,000	-0,037	-0,763	0,448	-0,001	0,001

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,950 / R Square = 0,903 / Adjusted R Square = 0,877 / Std. Error of the Estimate = 0,0107

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,051	0,016		3,262	0,002	0,020	0,082
$\Delta RoE2$	-0,023**	0,007	-0,159	-3,475	0,001	-0,036	-0,010
RoE	-0,036**	0,010	-0,190	-3,664	0,000	-0,056	-0,017
Manage $\Delta RoE2$	0,008*	0,003	0,118	2,506	0,015	0,002	0,014
Leverage	0,036**	0,011	0,184	3,383	0,001	0,015	0,058
RDTotal	0,081**	0,020	0,247	4,012	0,000	0,041	0,121
LagCapitalization	0,059**	0,023	0,109	2,528	0,014	0,013	0,106
HighCapitalizer	0,001	0,003	0,020	0,374	0,710	-0,005	0,008
Size	-0,006**	0,001	-0,479	-5,716	0,000	-0,008	-0,004
Growth	0,002	0,013	0,009	0,185	0,854	-0,024	0,029
GrowthExpectation	0,000	0,000	-0,020	-0,418	0,677	-0,001	0,001

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,954 / R Square = 0,910 / Adjusted R Square = 0,885 / Std. Error of the Estimate = 0,0104

Appendix 7: Regression model using  $\Delta NetIncome/Assets$  including *Manage*  
(own table)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,073	0,013		5,554	0,000	0,047	0,099
$\Delta NetIncome/Assets$	-0,135**	0,049	-0,193	-2,729	0,008	-0,233	-0,036
$NetIncome/Assets$	-0,201**	0,057	-0,297	-3,654	0,000	-0,324	-0,095
$Manage\Delta NetIncome/Assets$	0,007*	0,003	0,093	2,488	0,015	0,001	0,012
Leverage	0,000	0,013	-0,001	-0,016	0,987	-0,026	0,025
RDTotal	0,064**	0,018	0,195	3,515	0,001	0,028	0,100
LagCapitalization	0,057**	0,020	0,105	2,933	0,005	0,018	0,096
HighCapitalizer	-0,002	0,003	-0,039	-0,806	0,423	-0,008	0,003
Size	-0,006**	0,001	-0,425	-6,131	0,000	-0,007	-0,004
Growth	0,005	0,011	0,017	0,406	0,686	-0,018	0,027
GrowthExpectation	0,000	0,000	-0,022	-0,550	0,584	-0,001	0,001

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,968 / R Square = 0,938/ Adjusted R Square = 0,920 / Std. Error of the Estimate = 0,0086

Appendix 8: Regression model using  $\Delta NetIncome/Assets$  2 including *Manage*  
(own table)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,062	0,011		5,690	0,000	0,040	0,084
$\Delta NetIncome/Assets2$	-0,138**	0,046	-0,192	-3,039	0,003	-0,229	-0,048
$NetIncome/Assets$	-0,236**	0,052	-0,334	-4,521	0,000	-0,340	-0,132
Leverage	-0,002	0,012	-0,011	-0,182	0,856	-0,027	0,022
RDTotal	0,063**	0,018	0,191	3,427	0,001	0,026	0,099
LagCapitalization	0,060**	0,020	0,109	2,967	0,004	0,020	0,100
HighCapitalizer	0,000	0,003	0,002	0,036	0,972	-0,006	0,006
Size	-0,005**	0,001	-0,406	-5,603	0,000	-0,007	-0,003
Growth	0,004	0,011	0,016	0,389	0,698	-0,018	0,027
GrowthExpectation	0,000	0,000	-0,013	-0,308	0,759	-0,001	0,001

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,966 / R Square = 0,933/ Adjusted R Square = 0,915 / Std. Error of the Estimate = 0,0089

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,062	0,014		4,592	0,000	0,035	0,090
$\Delta$ NetIncome/Assets2	-0,134**	0,042	-0,186	-3,174	0,002	-0,219	-0,050
NetIncome/Assets	-0,246**	0,049	-0,349	-5,073	0,000	-0,343	-0,150
Manage $\Delta$ NetIncome/Assets2	0,009**	0,002	0,132	3,504	0,001	0,004	0,013
Leverage	-0,002	0,011	-0,008	-0,132	0,895	-0,024	0,021
RDTotal	0,068**	0,017	0,208	3,993	0,000	0,034	0,102
LagCapitalization	0,050**	0,019	0,092	2,656	0,010	0,013	0,088
HighCapitalizer	0,000	0,003	-0,006	-0,148	0,883	-0,006	0,005
Size	-0,004**	0,001	-0,342	-4,892	0,000	-0,006	-0,003
Growth	0,004	0,011	0,015	0,375	0,709	-0,017	0,025
GrowthExpectation	0,000	0,000	0,007	0,184	0,855	-0,001	0,001

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,971 / R Square = 0,943/ Adjusted R Square = 0,926 / Std. Error of the Estimate = 0,0083

#### Appendix 9: Regression model using $\Delta$ EPS including *Manage* (own table)

	Coefficients		Coefficients	t	Sig.	Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0,065	0,015		4,237	0,000	0,035	0,096
$\Delta$ EPS	-0,001**	0,000	-0,146	-3,338	0,001	-0,001	0,000
EPS	0,001	0,000	0,121	1,953	0,055	0,000	0,002
ManageEPS	0,011**	0,003	0,152	3,181	0,002	0,004	0,017
Leverage	0,048**	0,010	0,242	4,595	0,000	0,027	0,069
RDTotal	0,076**	0,021	0,233	3,601	0,001	0,034	0,119
LagCapitalization	0,079**	0,025	0,145	3,188	0,002	0,030	0,128
HighCapitalizer	-0,005	0,004	-0,074	-1,193	0,237	-0,012	0,003
Size	-0,009**	0,001	-0,683	-8,207	0,000	-0,011	-0,007
Growth	-0,021	0,014	-0,078	-1,559	0,124	-0,049	0,006
GrowthExpectation	-0,001	0,000	-0,059	-1,184	0,240	-0,001	0,000

The regression controls for years and industries  
 \*\*Significant at the 0.01 level / \*Significant at the 0.05 level  
 R = 0,949 / R Square = 0,901/ Adjusted R Square = 0,873 / Std. Error of the Estimate = 0,0110



Appendix 10: Regression model using  $\Delta EPS2$  including *Manage* (own table)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
<b>(Constant)</b>	0,065	0,017		3,918	0,000	0,032	0,098
<b><math>\Delta EPS2</math></b>	-0,001*	0,000	-0,099	-2,178	0,033	-0,001	0,000
<b>EPS</b>	0,001	0,000	0,103	1,560	0,123	0,000	0,002
<b>Leverage</b>	0,057**	0,011	0,287	5,261	0,000	0,035	0,078
<b>RDTotal</b>	0,077**	0,023	0,234	3,377	0,001	0,031	0,122
<b>LagCapitalization</b>	0,080**	0,027	0,147	3,027	0,003	0,027	0,133
<b>HighCapitalizer</b>	0,000	0,004	0,001	0,012	0,990	-0,008	0,008
<b>Size</b>	-0,009**	0,001	-0,687	-7,721	0,000	-0,011	-0,007
<b>Growth</b>	-0,019	0,015	-0,069	-1,297	0,199	-0,048	0,010
<b>GrowthExpectation</b>	0,000	0,000	-0,047	-0,886	0,379	-0,001	0,001

The regression controls for years and industries

\*\*Significant at the 0.01 level / \*Significant at the 0.05 level

R = 0,940 / R Square = 0,883 / Adjusted R Square = 0,852 / Std. Error of the Estimate = 0,0118

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
<b>(Constant)</b>	0,053	0,017		3,068	0,003	0,018	0,087
<b><math>\Delta EPS2</math></b>	-0,001*	0,000	-0,110	-2,422	0,018	-0,001	0,000
<b>EPS</b>	0,001	0,000	0,098	1,497	0,139	0,000	0,002
<b>ManageESP2</b>	0,006	0,004	0,089	1,604	0,113	-0,001	0,013
<b>Leverage</b>	0,059**	0,011	0,299	5,491	0,000	0,038	0,081
<b>RDTotal</b>	0,078**	0,023	0,238	3,461	0,001	0,033	0,123
<b>LagCapitalization</b>	0,076**	0,026	0,140	2,897	0,005	0,024	0,129
<b>HighCapitalizer</b>	0,000	0,004	-0,008	-0,128	0,899	-0,008	0,007
<b>Size</b>	-0,009**	0,001	-0,656	-7,293	0,000	-0,011	-0,006
<b>Growth</b>	-0,022	0,015	-0,079	-1,492	0,140	-0,051	0,007
<b>GrowthExpectation</b>	0,000	0,001	-0,030	-0,566	0,573	-0,001	0,001

The regression controls for years and industries

\*\*Significant at the 0.01 level / \*Significant at the 0.05 level

R = 0,942 / R Square = 0,887 / Adjusted R Square = 0,885 / Std. Error of the Estimate = 0,0117