

# Macro v.s. Micro Comparisons of Intangible Capital: The Case of Germany and the U.S.

**Charles Hulten**

University of Maryland, NBER &  
The Conference Board

**Janet Hao**

The Conference Board

**Kirsten Jäger**

The Conference Board

*Project funded by the European Commission under the Seventh Framework  
Programme  
Grant No 217512*

**Website :** [www.coinvest.org.uk](http://www.coinvest.org.uk)

**Email:** [coinvest@qmul.ac.uk](mailto:coinvest@qmul.ac.uk)

**COINVEST**  
[www.coinvest.org.uk](http://www.coinvest.org.uk)





# Macro Comparison

Table 1: Tangible and Intangible Investment 2006

%GDP	Tangible Investment	Intangible Investment	R&D	Innovative Property	Software	Economic Competency
US	8.20	11.48	2.25	4.37	1.61	5.50
Germany	9.24	7.16	1.72	3.59	0.73	2.84

Table 2: Source of LP Growth, 1995-2006

	Output/labor (%)	Intangibles (share)	ICT capital (share)	Non-ICT capital (share)	Labor comp (share)	TFP (share)
US	2.96	0.28	0.14	0.08	0.06	0.44
Germany	1.79	0.21	0.11	0.27	-0.08	0.49

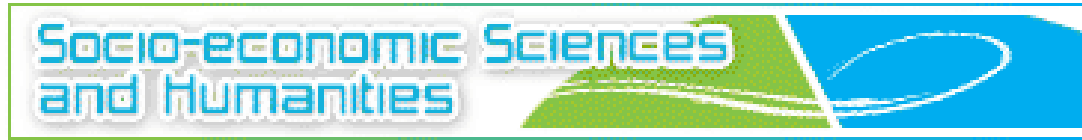
Source: van Ark, Hao, Corrado and Hulten (2009).

Notes: Output/labor is the average annual growth rates. The other variables are percentage share of the growth rate of output per hour.



# Literature Review

- Macro intangibles
  - Nakamura (1999, 2000)—first estimate of intangibles in GDP.
  - Corrado, Hulten, Sichel (2009)—first to put intangibles in source of growth analysis.
  - International comparison of sources of growth (Marrano, Haskel and Wallis, 2009, Fukao et. al. 2009, van Ark et al. 2009)
- Firm-level analysis
  - Lev (2001).
  - Hulten and Hao (2008).
  - Hulten (2010).
- This paper estimate intangibles of German companies and link firm level evidence to macro level international comparison.



# Research Issues

- Are the globally-competitive companies in an economy more intangible intensive than the average company?
- Do globally-competitive companies in different countries have similar intangible investment after controlling for industry effects?



# Market to Book Value Puzzle

## The Puzzle

Accounting Principle:  $\text{Equity} = \text{Assets} - \text{Liabilities}$

Theoretically:  $\text{Equity} = \text{Market Value}$

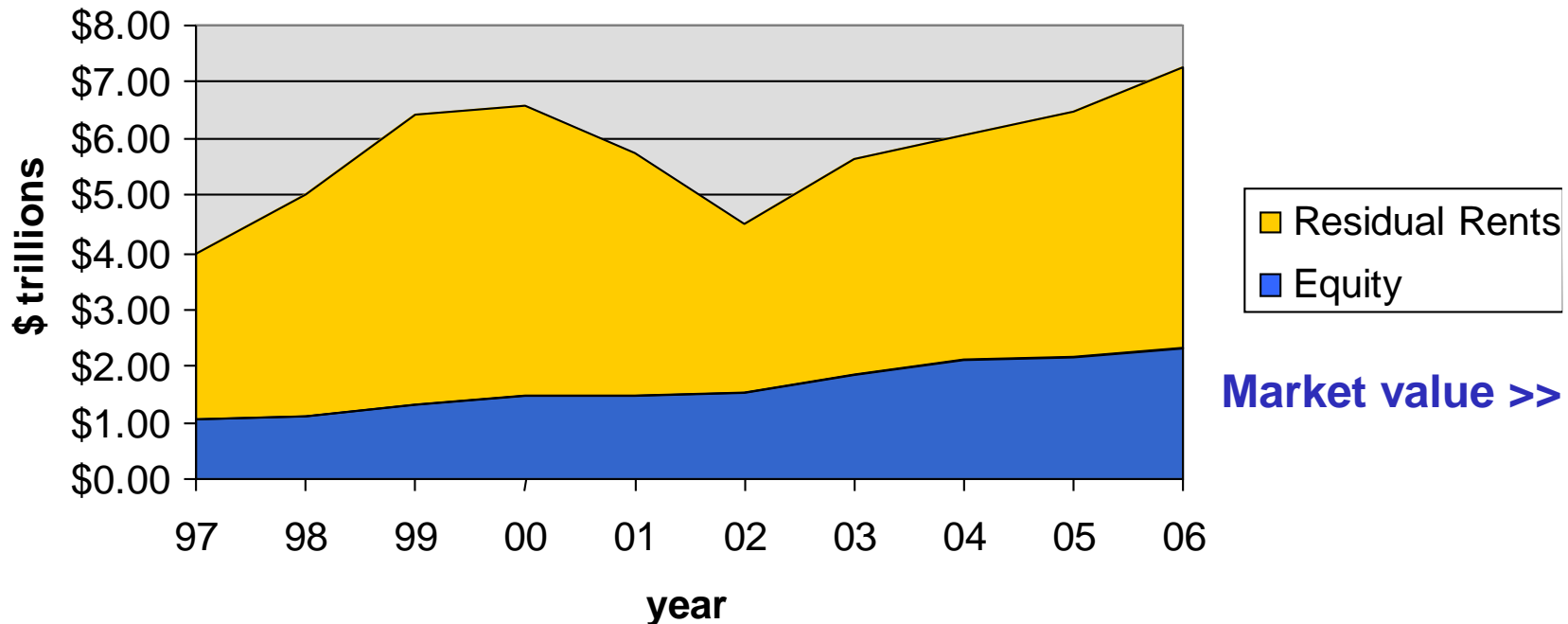
Actually:  $\text{Equity} \ll \text{Market value}$

- Absence of most intangible assets from financial statements
- Expenditure on intangibles produced within a firm often treated as a current expense, not as an investment in firm's future.  
⇒ No output or value created.
- No market transactions to measure the value of R&D and brand created within the company
- Difference between stock-market value of a firm and the book value of its equity treated as “goodwill” and (more or less) loosely associated with intangibles.



# Book Equity Does Not explain Market Values of U.S. Companies

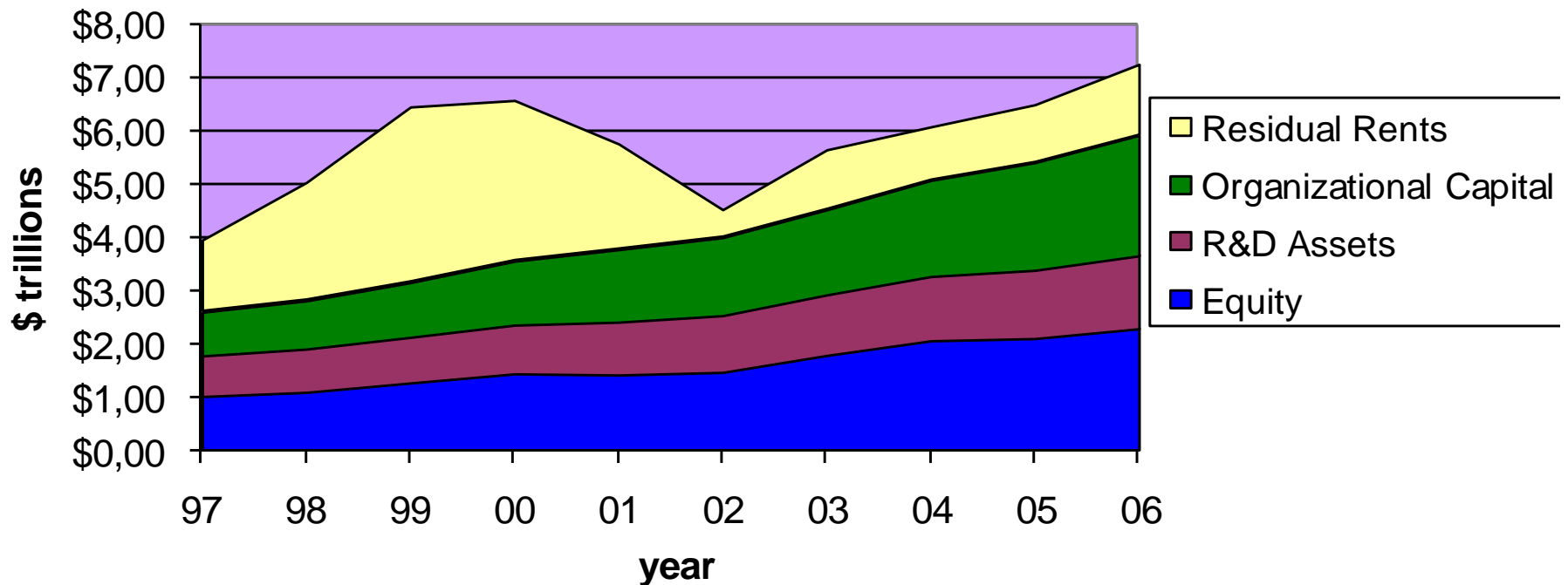
Decomposition of Stock Market Value  
Selected S&P Compustat Companies  
Source: Hulten-Hao (2008)





# Adding Intangible Assets Can Fill the Gap

Decomposition of Stock Market Value  
Selected S&P Compustat Companies  
Source: Hulten-Hao (2008)





# Micro Comparison

- We replicate Hulten and Hao (2008) for a sample of German/Swiss firms and compare results with the US
- Sample of 12 German/Swiss firms

Adidas AG	Merck KGaA (100)
Audi AG	Novartis AG (16)-Swiss
BASF SE (59)	SAP AG(58)
Bayer AG* (38)	Siemens AG (8)
BMW AG (31)	STADA Arzneimittel AG
Daimler AG (6)	Volkswagen AG (10)

- Data source: Financial statements of various years



# Methodology

Market-to-book gap is **too large** to be attributed solely to the mismeasurement of conventional equity / vicissitudes of the stock market

- Estimate the in-house investment in R&D and organizational capital
- Include “own” intangibles on corporate financial statements
- Construct balance sheets and income statements for German/Swiss firms with and without intangibles for 10 years
- Compare traditional financial statements with “new view” balance sheets and income statements
- Focus on two statistics related to intangibles
  - Rate of investment in own intangibles (R&D and organizational capital)
  - Percentage of market value explained
- Matched-company comparisons
  - ⇒ Compare performance of German companies with US companies



# Approach of the analysis

- **Traditional** balance sheet and income statement
- **New view** balance sheet and income statement:  
capitalize own R&D and organizational capital
  - Estimate the cost of in-house investment in R&D  
Current cost of R&D plus markup for profit (total operating surplus is allocated to R&D according to R&D's share in current expenses)
  - Estimate the cost of own production of organizational capital:  
CHS procedure - translate approximate proportions of brand equity and organizational development investment into a corresponding fraction of SG&A spending (~30%)
  - Amortization of R&D and organizational capital  
R&D: 10 year useful life – Organizational capital 5 year useful life
- **Comparison** of traditional and “new view” financial statements

# “New View“ Income Statement – German companies

## "New View" Income Statement Based on 12 Company Average 2008 (€ millions)

	Trad.	+R&D	+Org C.
1. Conventional Revenue	44,194	44,194	44,194
2. Own Production of R&D	0	2,553	2,553
3. Own Production of Org. Cap.	0	0	1,735
4. Total Adjusted Revenue (L1+L2+L3)	44,194	46,747	48,481
8. Total Current Cost (L5+L6+L7)	38,168	38,168	38,168
9. Operating Surplus (L4-L8)	6,026	8,579	10,313
10. Depreciation already accounted for	2,566	2,566	2,566
11. Amortization of Own R&D	0	2,320	2,320
12. Amortization of Own Org. Cap.	0	0	1,561
13. Adj. Operating Surplus (L9-L10-L11-L12)	3,460	3,693	3,866
15. Before-Tax Income (L13-L14)	3,009	3,242	3,415
17. After-Tax Income	2,393	2,626	2,799
18. Earnings per Share	3.34	3.67	3.91

Average of 11 German companies (Adidas, Audi, BASF, Bayer, BMW, Daimler, Merck, SAP, Siemens, Stada, and Volkswagen) + Novartis

# “New view“ Balance Sheet – German companies

"New View" Balance Sheet1  
Based on 12 Company Average  
2008 (€ millions)

<b>CONVENTIONAL BALANCE SHEET</b>	<b>Trad.</b>	<b>+R&amp;D</b>	<b>+Org C.</b>
2. Plant and Equipment	8,844	8,844	8,844
3. Purchased Intangibles	6,149	6,149	6,149
4. Goodwill	3,401	3,401	3,401
5. Other Assets	16,903	16,903	16,903
6. Total Assets (L1+L2+L3+L4+L5)	60,018	60,018	60,018
7. Total Liabilities	41,798	41,798	41,798
8. Equity	18,219	18,219	18,219
<b>ADJUSTMENTS FOR OWN INTANGIBLES</b>			
9. R&D capital	0	17,208	17,208
10. Organizational Capital	0	0	6,579
11. Assets adj. for Own Intang. (L6+L9+L10)	60,018	77,226	83,805
12. Equity adj. for Own Intang. (L8+L9+L10)	18,219	35,426	42,006
<b>COMPANY VALUATION</b>			
13. Market Value of Equities	38,402	38,402	38,402
17. Total Intangible Assets (L3+L4+L9+L10)	9,551	26,758	33,338
18. Tobin's equity Q (L13/L12)	2.11	1.08	0.91
19. Percent MV Value Explained (1/Q)	0.47	0.92	1.09

Average of 11 German companies (Adidas, Audi, BASF, Bayer, BMW, Daimler, Merck, SAP, Siemens, Stada, and Volkswagen) + Novartis



## Comparison of Key Statistics from the U.S. and German Firm Analysis

<i>2008</i>	<i>US-633</i>	<i>US-18</i>	<i>Ger-12</i>
R&D spending/conventional revenues	0.04	0.08	0.05
R&D+Org. spending/conventional revenues	0.17	0.28	0.15
%MV explained w/o Intan	0.30	0.29	0.47
%MV explained w Intan	0.77	0.80	1.09
ROE w/o Intan	0.33	0.15	0.12
ROE w/ Intan	0.17	0.08	0.07
Debt/EQ w/o Intan	2.15	2.50	1.96
Debt/EQ w/ Intan	0.83	0.89	0.90

Source: US-633 firms are from the updated results of Hulten and Hao (2008)



## Comparison of U.S. and German IT and Pharmaceutical Companies

2008	IT <sup>1</sup>		PHARMA <sup>2</sup>	
	US	Germany	US	Germany
R&D Spending / Revenues	0.07	0.06	0.17	0.12
Org Spending / Revenues	0.18	0.16	0.28	0.26
EQ/MCAP w/o Intang	0.24	0.33	0.29	0.44
EQ/MCAP w/ Intang	0.69	0.96	1.00	1.13
ROE w/o Intang	0.25	0.22	0.21	0.12
ROE w/ Intang	0.13	0.07	0.11	0.08
Debt/Equity w/o Intang	1.42	2.14	1.19	1.03
Debt/Equity w/ Intang	0.49	0.73	0.34	0.40

Notes: 1. German IT Companies: SAP and Siemens; U.S. IT Companies: Oracle, Apple, Intel, IBM, HP, Cisco and EMC. 2. German+ Pharmaceutical Companies: Bayer, Merck, Stada, Novartis; U.S. Pharmaceutical Companies: J&J, Pfizer, ABT, Bristol Myer, Eli Lilly and Wyeth.



## Six Group-wise Comparisons of Companies by Industry

	GE	UTX	Siemens	J&J	Bayer	Pfizer	Novartis
R&D Inv/Adjusted Revenue	0.02	0.03	0.05	0.13	0.08	0.22	0.17
ORG Inv/Adjusted Revenue	0.10	0.04	0.04	0.11	0.09	0.11	0.09
%MV explained w/o Intan	0.41	0.26	0.42	0.23	0.41	0.44	0.43
% MV explained w Intan	0.76	0.58	1.20	0.76	1.22	1.45	1.08
ROE w/o Intan	0.15	0.29	0.21	0.30	0.11	0.14	0.14
ROE w/ Intan	0.11	0.17	0.05	0.15	0.05	0.08	0.09
Debt/EQ w/o Intan	6.02	2.55	2.45	1.00	2.21	0.93	0.55
Debt/EQ w/ Intan	3.26	1.13	0.86	0.31	0.74	0.28	0.22
	Forest	Stada	Oracle	SAP	Dow	DuPont	BASF
R&D Inv/Adjusted Revenue	0.18	0.03	0.16	0.15	0.02	0.05	0.02
ORG Inv/Adjusted Revenue	0.12	0.10	0.11	0.07	0.01	0.04	0.03
%MV explained w/o Intan	0.36	0.39	0.22	0.18	0.45	0.19	0.51
% MV explained w Intan	1.01	0.78	0.52	0.58	0.83	0.64	0.96
ROE w/o Intan	0.26	0.10	0.24	0.26	0.04	0.28	0.16
ROE w/ Intan	0.18	0.11	0.20	0.15	0.04	0.06	0.10
Debt/EQ w/o Intan	0.22	1.94	1.05	0.94	2.37	4.08	1.72
Debt/EQ w/ Intan	0.08	0.97	0.45	0.30	1.28	1.28	0.91 <b>15</b>



# Caveats

- “New view” estimates on intangibles are inaccurate.
  - ⇒ based on imputations rather than on market transactions
  - ⇒ inferred from the cost of investment
- The German sample is much smaller
  - ⇒ more prone to idiosyncratic variation
  - ⇒ more heavily weighted to the auto industry
- Differences in corporate structure & governance may matter, so accounting differences may not reflect underlying structural differences
- Different accounting system in the US and Germany:  
US GAAP vs. IFRS



# Treatment of R&D under US GAAP and IFRS

## US. GAAP

- All costs related to research and development are expensed as incurred, with few exceptions (certain website development costs and costs associated with developing internal use software)

## IFRS: IAS 38

- Differentiation between “research” and “development” costs
- Research expenses are expensed as incurred
- Development costs are capitalized if specified criteria are met
  - Development cost can be measured reliably
  - The product is technically and commercially feasible
  - Future economic benefits are probable
- Conditions for capitalization are often not satisfied in full  
⇒ development costs mostly expensed



# Conclusions

- Capitalized internal R&D and organizational capital  $\Rightarrow$  large impact on income statements and balance sheets both countries
- Own-intangibles appear to be more important in U.S. business, though this is not a general rule
- Current practice of largely omitting intangibles from financial statements  $\Rightarrow$  biased perspective about the drivers of company value
- Addition of internally intangibles increases the percentage of market value that can be explained by equity
- Over-explanation may be caused by our assumptions on own R&D and organizational capital
- Leading R&D oriented firms exhibit higher R&D investment rates than average firms
- Intangibles *can* explain most (or all) of the market-to-book gap does not necessarily mean that they *actually do* explain the gap



# Resumé

Are the globally-competitive companies in an economy more intangible intensive than the average company?

⇒ YES

Do globally-competitive companies in different countries have similar intangible investment after controlling for industry effects?

⇒ YES