Macro versus Micro Comparisons of Intangible Capital: The Case of Germany and the U.S.

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ABSTRACT:

A growing body of research has documented the rapid growth of investments by U.S. companies in research and development, sales and marketing, and organizational capital, and found that these investments, collectively called intangibles, are an important driver of output growth and company value. Similar studies have been carried out for Japan and selected countries in Europe, and generally find the intangibles are an important source of growth. However, these findings refer to the average performance of companies in their respective economies, and not the leading participants in the global economy. This paper looks behind these aggregate numbers to the experience of individual multinational companies with large research budgets in Germany and the U.S. Unlike the average German company that trailed the U.S. in the rate of R&D spending, German companies were found to be comparably R&D intensive but less intangible-intensive when organizational capital is taken into account. These results suggest that while German companies on average exhibit lower R&D intensities, at the margin of international competition they are hard to distinguish from their U.S. counterparts in this dimension.

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I. Introduction

A growing body of research has documented the rapid growth of investments in research and development, sales and marketing, and organizational capital by U.S. companies. These investments, collectively called "intangibles", are an important driver of output growth and company value. Similar studies have been carried out for Japan and selected countries in Europe, and intangibles are also found to be an important source of economic growth.

In the most comprehensive comparison to date, van Ark, Hao, Corrado, and Hulten (2009) compare the fraction of business-sector GDP allocated to intangible investments in ten European countries and the U.S. The U.S. is found to be the most intangible-intensive economy, as measured by the investment rate, followed by the U.K., France, and Germany. The U.S. also led in R&D, broadly defined, followed by Germany. These intangible intensities were found to be positively associated with income per capita, labor productivity, market capitalization, and venture capital as a percent of GDP.

These findings generally support the idea that intangible investments are an important part of a national strategy designed to increase productivity and international competitiveness, as articulated, for example, by the Lisbon Agenda and by the Secretary of Commerce's *Advisory Committee on Measuring Innovation in the 21th Century*, and by the OECD (2010). However, much of the available evidence is based on the *average* performance of companies in their respective economies. A policy aimed at raising the performance of the average firm in an economy may have a domestic payoff, but the goal of promoting international competitiveness requires companies to compete at the margin against firms from other countries in the global economy. The case for intangibles as part of a competitiveness strategy should therefore look at the following questions: Are the globally-competitive companies in an economy more intangible-intensive than the

average company, and do globally-competitive companies in different countries have similar intangible intensities after controlling for industry effects? These are the questions addressed in this paper.

These questions are not easily answered. Many important intangibles investments are not reported on corporation financial statements (those produced within companies) and, moreover, there are idiosyncratic differences among countries, as well as firms within countries. No two companies anywhere are exactly the same. However, some insights can be obtained by analyzing the financial statements of companies in difference countries, supplemented by estimates of internally-produced intangibles, again, R&D, marketing, and organizational capital. This is the approach in this paper, following the approach developed in Hulten and Hao (2008). We expand that study to include a sample of leading German companies (plus one Swiss company), and then interpret the comparative results in light of the macro comparisons available from van Ark-Hao-Corrado-Hulten (2009). Our main result is that R&D intensities are roughly similar in the U.S. and German companies studied, but are different in the macroeconomic studies of the U.S. and Germany. There is some evidence that the German firms are less intensive in the other forms of intangible capital.

II. Innovation and Intangible Capital

Two quotes succinctly frame the issues dealt with in this paper. The first, from Dougherty et. al. (2007), sets out the policy context linking the rate of R&D investment to improving long-run economic outcomes:

> "Concerns with science and technology (S&T) capabilities are widespread in the United States as well as in other developed countries. This is understandable in light of the importance of knowledge and technology in generating long-run growth of productivity, per capita income and employment. Trends and levels of research and development (R&D) spending and, in particular, the ratio of R&D expenditure to gross domestic product (GDP) or national income are often used as

> a measure of innovativeness as they capture the resources devoted to achieving future technological change. Despite interpretation issues, trends and levels of R&D spending and R&D intensity measures are a key focus of policy discussions across the world. In Europe, for example, governments at the Barcelona European Council noted that European R&D expenditures are well below those of the U.S. and set a target to dramatically increase R&D spending from 1.9% of GDP to 3.0% by 2010 (European Commission 2002)." (citation from Dougherty et. al., pages 291-292).

The importance attached to R&D spending as part of a national strategy is also reflected in the U.S. R&D tax credit.

The second quote, by Mandel (2006), suggests that R&D spending is not, by itself, a sufficient condition for innovation:

> "1Grab your iPod, flip it over, and read the script at the bottom. It says: 'Designed by Apple in California. Assembled in China.' Where the gizmo is made is immaterial to its popularity. It is great design, technical innovation, and savvy marketing that have helped Apple Computer sell more than 40 million iPods."

Two essential points are made here. First, it is not just the ability to make goods that counts in a modern economy. This is important because standard economic theory links economic growth to the production function, and links innovation to the shift in that function --- i.e., to improvements in the efficiency with which goods are made. Mandel reminds us that this is not the right way to understand innovation in a technology company like Apple. The same might be said for many technology companies in the United States, as well as firms like Walmart and Goldman Sachs that are not usually thought of as high technology companies.

The second point is equally important. R&D is often an important part of the innovation process, but it is only one part. Product design and marketing are important coinvestments that are needed to realize the value of the technical advances made in the R&D laboratories. Why, for example, would a pharmaceutical company spend a $1 billion developing a new drug and then spend nothing launching the product in the market place? IBM's Emerging Business Opportunity program is explicitly designed to

commercialize ideas developed in its own R&D labs, by identifying market opportunities and working with prospective customers to shape the product to the clients' needs. Commercially successful innovation is thus an interaction between the development of new ideas (borrowed or discovered) and the development of the markets into which the products will be launched. In other words, investments in the innovation involve more than R&D alone, and this is the rationale for the focus on intangible capital.

The principal barrier to progress in this direction has been an absence of the data needed to analyze own-produced intangibles. Both financial accounting practice and national income accounting procedures have traditionally treated own-intangibles (including R&D) as a current cost of business and have thereby effectively ignored them as investments in innovation. Data on R&D expenditures, as well as some other intangibles, do exist but are usually not integrated into national or financial accounts as investments (although this is beginning to change, with the launch of an R&D satellite account to supplement the national accounts).

III. Accounting for Intangible Capital in the Macro Economy

Treating own-intangibles as an investment essentially means treating them the same way as tangible capital. With tangibles, the value of the investment is added to GDP (C+I+G) and also to the value of assets in the national wealth account, after adjusting for the depreciation. Estimates of a broad range of intangibles in the macro economy were made by Nakamura (1999, 2001), followed by Corrado, Hulten, and Sichel (2005), with the result that some $1 trillion was added to U.S. GDP in 2000, rising to $1.6 trillion in 2007. U.S. national wealth is also increased by $5 trillion with the addition of the accumulated stock of intangibles (Corrado and Hulten (2010)). Moreover, the rate of

intangible investment in 2006 exceeded that of tangible investment, 11.48 versus 7.2 percent of GDP.

Table 1 reports the three main components of intangible investment; software, innovative property (including R&D), and economic competencies (including brand equity, organizational capital and worker training). The economic competency category is by far the largest, and accounts for almost half the total investment, while R&D by itself accounts for only 20 percent. This table also reports investment rates for the three largest economies of Europe, extracted from the 10 country study by van Ark, Hao, Corrado and Hulten (2009), and therefore provides the macroeconomic context for the comparison of German and U.S. companies in this paper. The total intangible investment rate for Germany is around 62 percent of the corresponding U.S. rate, while the German R&D investment is around 76 percent. On the other hand, the German *tangible* investment rate is 13 percent higher, in keeping with the larger emphasis on manufacturing industry in the German economy.

Table 2 shows the Solow sources of growth of labor-productivity (output per working hour) for the countries of Table 1, from 1995 to 2006. The average annual growth rate of labor-productivity in the U.S. was 2.96 percent, compared to the German rate of 1.79 percent. Following Solow, the growth rates are decomposed into their "sources", which, in this case, means the weighted growth rates of the stock of intangibles per hour worked, ITC tangible capital per hour, non-ITC tangible capital per hour, a labor-force composition term, and a residual estimate of multi-factor productivity. The contribution of intangibles averages 24 percentage points in the four countries and is the largest systematic (non-MFP residual) source of growth in the U.S., France, and the U.K., whereas in Germany that honor goes to non-ITC capital per hour, in keeping with the

importance of the manufacturing sector in that country. Even so, the contribution of intangibles to German is still significant.

One conclusion emerging from this analysis is that intangibles are an important source of growth in the world's leading economies. Omitting intangibles from the analysis of growth, the practice until quite recently is to leave out about one-quarter of the force behind improvement in labor productivity. And, from the standpoint of this paper, another important conclusion is that intangibles played a greater role in the growth of the U.S. economy than they did in Germany, a result that provides the context for the issue of whether the average intangibles gap carries over to the comparison of large multinational companies in the two countries.

IV. Intangible Capital and Market Capitalization

In a world of perfect information and no frictions, a dollar invested in a company's assets should raise its value in the stock market by one dollar. While stock market valuation is far from perfect (Hall (2001)), there is evidence that investments in R&D, advertising, worker training, and organizational efficiency are positively correlated with market capitalization. This correlation is apparent in Figure 1, taken from van Ark, Hao, Corrado, and Hulten (2009), in which the rate of intangible investment is plotted against the ratio of market capitalization to GDP. This chart reveals a positive association between the two variables, but not necessarily causality, although the weight of evidence in the literature on the subject suggests that there is, on average, a positive future payoff to current expenditures on intangibles like R&D, worker training, and marketing.[1] The

[1] Intangible capital is an endogenous variable in a much larger economic system, but, so is tangible capital. A significant body of literature explores the link between expenditures on intangibles and increases in productivity and company value. This literature is reviewed in Corrado, Hulten, and Sichel (2005, 2006), Brynjolfsson and Saunders (2010), and the introductory comments of Corrado, Haltiwanger, and Sichel (2005). The general thrust of these studies is that a broad list of own-intangibles should be treated as capital expenditures.

example of the pharmaceutical drug development, with its very long product development lags, provides compelling evidence in favour of this proposition (Hulten and Hao (2008), and the references cited therein).

The market-to-book value gap can be interpreted as further evidence that intangibles have a capital value. Baruch Lev was among the first to point to omitted intangibles as a major source of the gap between the stock market valuation of a company and the corresponding accounting book value (see Lev (2001)),[2] though interest in this issue initially focused on the anti-trust implications of the gap.[3] The average price-to-book value ratio of the companies in the S&P 500 is currently around 2.0, meaning that shareholders are willing to pay twice the book value of the shareholder equity reported on the balance sheets of these companies (for the technology-heavy NASDAQ 100, the multiple is around 4.0). The size of the gaps fluctuates over cycles in the stock market, but the gap persists.

One obvious culprit is the absence of R&D and other own-intangibles from the balance sheet, but how much of the price-to-book gap can these intangibles explain? Conventional accounting generally values balance sheet items at historical cost rather than current value, and book values thus tend to be undervalued during periods of price inflation. This factor causes part of the price-to-book gap. How much, then, is left to intangibles? A direct approach to this question was taken by Hulten and Hao (2008),

[2] The market value of a company is the value of its shares as determined by the stock market at any moment in time. The book value of a company is based on generally accepted accounting rules, and tends to reflect the historical cost of acquiring assets.

[3] A substantial literature evolved to point out the potential unreliability of using accounting rate of return estimates as an indicator of monopoly power (e.g., Machlup (1952)). This issue is examined in Clarkson (1977) from the standpoint of the intangible assets omitted from corporation financial statements. In his study, Clarkson capitalizes R&D and "sales and promotion" expenses and supplements the conventional financial accounts with results. He reports that the uncorrected return on net worth was around 18 percent per year in the late 1960s, while the intangibles-corrected rate was less than 12 percent. Though the details of these calculations differ from those in our paper, and our focus is on the valuation of innovation assets, this work is the conceptual ancestor of the results presented here and in Hulten and Hao (2008).

who capitalized the own-account intangibles of 617 R&D-oriented U.S. companies using financial accounting data obtained from the COMPUSTAT database. An analysis of a subsample of six of the seven largest U.S. pharmaceutical companies was also carried out.

The main finding was that when R&D and organizational expenditures are capitalized and added to the balance sheet at their estimated cost, the percentage of the market capitalization explained by book value in 2006 rose from 31 to 75 percent for the 617 firm sample, and the historical cost correction another 23 percent; for the pharmaceutical companies, the percentage explained rose from 26 to 79 percent, with the historical cost correction adding another 10 percent. The remaining gaps may reflect the fact that the samples were selected on the basis of whether a company had a more-or-less continuous 20-year record of spending on R&D. The sample may therefore be biased in favour of companies that were, on average, more successful at innovation than the population as a whole, and therefore earned Schumpeterian rents.

V. Own-Intangible Assets in German Companies

This paper extends the Hulten-Hao methodology to the financial data of a small sample of R&D-intensive German corporations plus one Swiss company, mostly in the auto, pharmaceutical, and IT industries. Germany was selected because of its success in international markets and because of data availability, and the Swiss firm, Novartis, was added to expand the list of pharmaceutical companies. We estimate the cost of in-house investment in R&D and organizational capital for 2008 using data for the period from 1999 to 2008, construct the corresponding capital stocks, and then adjust the financial statements to include intangibles.

Table 3 lists the German+ corporations selected for this paper. The numbers in parentheses indicate the rank amongst the top 100 R&D spenders worldwide in 2006

published by Spectrum. The size of the sample is small compared to the U.S. sample studied by Hulten and Hao because we did not have access to a large data source like COMPUSTAT and had to process 10 years of financial statements for each company by hand. Expanding the sample size is a priority for further research. We also note, here, that German companies follow the rules of International Financial Reporting Standards (IFRS), and we spend a substantial amount of effort in reconciling this standard with U.S. GAAP rules. A discussion of this reconciliation is presented in Appendix I.

There is a fundamental asymmetry in accounting practice about how financial statements treat R&D. R&D is capitalized when the R&D is produced externally but expensed when it is produced internally, except for the fraction of development costs that can be capitalized if certain criteria are met under IFRS - which in practice is not often the case. Following Hulten-Hao (2008), we treat all internally generated R&D capital as an increment to capital and estimate the amount of investment, except the fraction of development costs that met the criteria for capitalization under IFRS. In making this calculation, we start with R&D expenditures reported on the company books as a cost and then add an estimate of the profit margin to reach the shadow value of the investment.[4] Because the actual magnitude of the profit margin is unknown, we use an imputation procedure that allocates the total operating surplus to R&D according to R&D's share of current expense. The result is the shadow value of the investment to the company measured at production cost, which we assume equals the discounted present value of the expected income generated by the asset.

As with plant and equipment, R&D investments depreciate in value over time. There is, however, an important difference. Machines lose value because they are used

[4] The following thought experiment illustrates the rationale for the profit adjustment. Suppose that rather than producing intangibles within Company X, the company were to outsource this function to another firm, Y. If Y spends, say, $1 billion in current outlays to produce the research, and then sells it to X. The price charged to X would include a markup for profit.

up in production due to wear, tear, and accident, or because of obsolescence arising from the development of superior types of machinery. R&D capital, on the other hand, is more closely tied to the output it generates. It is therefore subject to losses in value arising from competition from superior types of output, not superior inputs, as in the machinery case. Another source of obsolescence arises from the fact that R&D knowledge is largely a non-rival good, a good whose benefits can accrue to other users without diminishing the quantity available to the originator. The value of the R&D to the originator is limited to the commercial value that can be extracted from the investment, and this value depends on the ability to protect the intellectual property rights associated with the asset via patents, copyrights, and secrecy. As the knowledge embodied in the R&D eventually diffuses to competitors, that value is eroded. The appropriate obsolescence rate for R&D is thus somewhat idiosyncratic, and we decided to amortize own production of R&D over a useful life of 10 years based on the available literature.

Companies also invest in marketing, organizational development (e.g., strategic planning, new management systems), and worker training. As with R&D, we start with expenditures reported on the company books as a cost and then add an estimate of the profit margin to reach the shadow value of the investment. However, unlike R&D, not all of marketing and organizational outlays are treated as investment. Moreover, our data only permit us to break out R&D outlays from overhead cost (SG&A). We are thus forced to impute a share of the non-R&D portion of SG&A to non-R&D intangibles to capital formation, and based on the macro estimates by CHS, we impute 30% of SG&A net of R&D to investment in marketing and organizational capital. We then amortize the investment over a useful life of 6 years.[5]

[5] Brand equity loses value when new goods appear in the market place or the marketing programs of competitors cut into market share, and human capital erodes through worker attrition and with the adoption of new products, processes, and business models. Management competencies erode for many of the same reasons.

The last step in capitalizing intangibles is to form the investment series into capital stocks. The first step in developing the stock estimates is to convert the current price value of the investment series to constant prices (the "real" value), using a price deflator for each type of intangible: for R&D, we use the U.S. BEA R&D price deflator; for the other intangibles, we use price deflators obtained from the study of intangibles in Microsoft Corporation (Hulten (2010)). The constant price investment series are then added to the corresponding capital stock from the end of the preceding year, after a deduction for the depreciation of that stock. This recursive process is the so-called "perpetual inventory method" of estimating capital. The stock estimated in this way is in constant prices and must be deflated to arrive at its current dollar value.

Once these calculations are complete, the current dollar investment is added to revenue on the top line of the corporation income statement. Top-line revenues in Column 1 represent the cash inflow to the firm, while the imputed dollar amount of own-intangible investment in the other columns is the gross non-cash value (or shadow price) to the shareholders of creating more intangible capital within the company. However, the net amount of value created is the difference between the gross value of intangibles added to the top line and the additional depreciation generated by the stocks of intangibles. The net result can be positive or negative, depending on whether the intangible stock is growing or shrinking. The following section gives the actual results of this capitalization process.

VI. Traditional and "New View" Financial Statements for German Companies

The procedures outlined in the preceding section are implemented for our sample of German companies in Tables 4 and 5. The first column (marked "Trad.") shows the

income statement of the 12 companies under currently prevailing accounting practice. These firms had a combined revenue of some 44.2 billion euros in 2008, and total current cost of almost 38.2 billion, resulting in an after-tax income of 2.4 billion euros. Intangibles are capitalized in two steps. First, the 2.1 billion euro cost of R&D in the second column of Table 4 is grossed up by a profit margin to 2.6 billion euros and added to conventional revenue to arrive at a new top line of 46.7 billion euros. This additional 2.6 billion is not a cash accrual, but an implicit capital accrual. The net capital accrual is 0.23 billion euros, since the implicit gross capital accrual is 2.6 billion and the depreciation of R&D capital stock is 2.3 billion. As a result, earnings per share rise from 3.34 to 3.67 euros.

The last column of Table 4 reports the effects of capitalizing organizational capital and adding it to the adjacent column. Because only 30 percent of the outlays for SG&A are considered to be an investment, the top line increases by 1.7 billion to 48.5 billion euros. Additional depreciation is 1.6 billion euros, and after-tax profit rises to 2.8 billion euros, and earning per share to 3.91 euros. In total, bottom-line earnings per share rises by 0.57 euros, or 17 percent, a source of value not captured by conventional accounting procedures.

The 2008 stocks of R&D and organizational capital appear on the balance sheet in Table 5. The stocks were estimated using the perpetual inventory method described in the preceding section. R&D stocks equal $17.2 billion euros, and organizational capital stocks equal $6.5 billion euros. The total result was to increase the total assets of the 12 companies from 60.0 billion to 83.8 billion, and shareholder equity from 18.2 to 42.0 billion euros. Since the market capitalization of these companies was 38.4 billion, the price-to-book ratio increases from 0.47 to 1.09. In other words, adding intangibles to the balance sheets more than explains the market-to book value puzzle for this collection of

German firms. This over-explanation may reflect errors in the underlying assumptions, like the rate of depreciation and the amount of SG&A that is considered to be capital investment, but as we will see in the next section, this result is not out of line with macroeconomic results from the van Ark et. al. study.

VII. Comparison of U.S. and German Companies

The cross-national study by van Ark et. al. focused on the market sectors of the respective economies, which is to say, on a broad array of companies in each economy. The U.S. was found to have the highest rate of intangible investment, as well as the highest rate of R&D investment compared to the four largest economies of Europe. Germany was fourth in the overall intangibles' rate, 40 percent behind the U.S., and second in the R&D rate, 24 percent behind the U.S. If, following Dougherty et. al., these ratios are taken as "measures of innovativeness" in "policy discussions around the world," one interpretation of these findings is that an innovation gap exists between the Germany and the U.S. Yet, German products are highly competitive in world markets including the U.S. market, and Germany is currently running a trade surplus unlike the U.S.

The comparison of selected U.S. and German companies in Table 6 sheds light on this issue.[6] The 12 German+ companies (labeled GER-12) are compared, there, to the two samples of U.S. companies: the first is the original Hulten-Hao sample updated to 2008 (US-633), while the second is a more focused sample of 18 U.S. IT and pharmaceutical companies (US-18). A comparison of the GER-12 and US-633 shows that the rate of investment in R&D (spending as a fraction of revenue) is virtually the same in the two samples, 0.05 versus 0.04, with GER-12 showing a slight edge. The rate

[6] The macro Tables 1 and 2 refer to the year 2006, while the company tables refer to 2008. The 2008 date was selected because of the time span needed to construct R&D stocks. Versions of Table 4 and 5 were prepared for 2006, but the key ratios were virtually the same as in 2008.

of investment in all intangibles is similarly close, 0.15 versus 0.17, with the US-633 having a modest edge. The gaps between the US and Germany apparent in the macro estimates of Table 1 are smaller in Table 6 or go the opposite direction. In other words, a sample of the leading R&D-oriented firms suggests that the average intangibles gap narrows or disappears at the margin. It is also noteworthy that the investment rates for intangibles are quite a bit higher for these companies than for the market sector as a whole.

Table 6 reports other statistics of interest. The percentage of the market capitalization rises 47 percentage points when intangibles are included in the US-633 sample to the point that it explains 77 percent of the market cap. In the US-18 sample, the corresponding numbers are 51 percentage points and 80 percent. The Germany companies, on the other hand, start from a significantly higher point, with conventional equity explaining more than half of company market cap. The addition of intangibles adds 63 percentage points to this number, and market capital is now overexplained. This may reflect the dynamics of German equity markets, firm-specific valuation issues, or errors in measurement (e.g., the assumption that German companies allocate the same fraction of their non-R&D SG&A cost (30 percent) to investment in organizational capital).[7]

The higher fraction of market capitalization explained by conventional equity in Germany could also be related to the argument put forward by Black and White (2003), who find that the book value is a more important determinant of market value there than earnings, whereas the opposite is true for the US. This finding is reinforced by the observation by Mintz (2006) that German corporate governance follows a stakeholder

[7] However, the fraction of the market capitalization accounted for by book value of equity was also calculated without intangibles, and was still found to be greater in the German companies.

model whereas the shareholder model is dominant in the U.S. This difference may lead to less emphasis on maximizing shareholder market value in Germany.[8]

The difference in sample sizes is yet another potential problem. To address this issue, a second comparison is made in Table 7 between 18 IT and pharmaceutical companies in The U.S. and the GER-12 sample. The picture is somewhat clouded by this comparison. Here the intangible investment rates are considerably higher in the US-18/GER-12 comparison. The IT subsample gives results that are similar for the companies in both countries, but the pharmaceutical sector in the U.S. is considerably more R&D intensive. This result calls attention to the importance of industry dimension when making cross-national comparisons.[9]

Table 8 continues the process of disaggregation by comparing individual companies directly. Six groups of roughly similar firms are examined, starting with United Technology (UTX), General Electric (GE), and Siemens in the technology-oriented industrial space. These companies have different product mixes and are hard to compare directly, though there is as much diversity between the two American companies as with Siemens. In any event, there is little encouragement for the hypothesis of lagging intangible expenditures in the German company. Siemens has the largest R&D

[8] The ownership structure of German joint stock companies is quite different from that of US corporations. Ownership of publicly traded companies in Germany tends to be concentrated and closely related to strategic interests of other organizations while minority shares play a limited role. Ownership structures are often complex with interlocking relationships between listed companies. German banks play also a major role in monitoring corporate governance through large equity stakes, credits, and representation in the supervisory boards. Moreover, German companies operate under creditor-oriented and tax-based accounting principles (Jermakowicz et. al., (2007) and Mintz, (2006)).

[9] The importance of the industry dimension is highlighted in OECD (2010). Table 2.4 of this report shows the allocation of R&D spending between high-technology and non-high tech manufacturing industries in a number of countries. In the U.S., around two-thirds of 2006 spending was concentrated in the high-tech sectors of manufacturing, while only about one-third was attributed to these sectors in Germany. And, another caution is in order: the Treaty of Maastricht established the European Union in 1993, and the Euro was launched in 1999. The ten-year sample period for the German firms (1998-2008) was thus a period of significant economic change.

investment rate of the three, and is tied with UTX in organizational capital's investment rate.

The next three groups are drawn from different segments of the pharmaceutical sector. Bayer and Johnson & Johnson are number three and five pharmaceutical firms ranked by worldwide sales in 2008. They are also diversified companies, with 47 percent of Bayer's revenues coming from pharmaceutical sales, and 40 percent for J&J. Bayer is less intensive in R&D investment, and somewhat less intensive in organizational investment, in line with the preceding table. The next comparison pits Novartis, the world's leading pharmaceutical company in terms of 2008 revenues, against number two Pfizer. These two companies are less diversified than Bayer and J&J (Pfizer gets 92 percent of its revenues from pharmaceutical sales), and again the pattern is consistent with that of Bayer/J&J in Table 8 and that of the pharmaceutical companies in Table 7, though Novartis clearly invests heavily in R&D (17 percent of revenues).

The third comparison of pharmaceutical companies is between smaller specialty producers Stada and Forest. However, the pair-wise difference between the R&D investment rates is large in Table 8. The investment rates of organizational capital are comparable.

The final two comparison sets are between leading software firms Oracle and SAP, and chemical industry giants BASF (the leader in world sales in 2007), Dow Chemical (second), and DuPont (sixth). Oracle and SAP are very similar in all dimensions. This is not surprising since they are close competitors. The large chemical companies have very low rates of R&D investment, with BASF the same as Dow, and BASF intermediate between Dow and DuPont in the organization giants. Bayer might also be added to this group and as well to the large pharmaceuticals, because it is the world's eighth largest chemical company. This diversified product mix may explain the

relatively low R&D investment rate (low for pharmaceuticals and high for chemicals), again pointing to the importance of understanding industry mix when studying intangibles.

VIII. Conclusions

This paper sets out to examine the following questions: Are the globally-competitive companies in the German and American economies more intangible-intensive than the average company, and do globally-competitive companies in different countries have similar intangible intensities after controlling for industry effects? The answer to the first question is a resounding "yes." The R&D investment rates for the U.S. companies in Tables 6, 7, 8, are considerably higher on average than the 2.25 percent rate for the market sector as a whole shown in Table 1. The same is true for investment in organizational capital (or non-R&D intangible capital). In the German case, the Table 1 macro rate for R&D is 1.72 percent, but 5 percent for the 12 German+ companies (for the organizational capital rate, the numbers are 5.4 percent versus 15 percent). Intangible capital is more important in the largest globalized companies of both countries than it is for the average company.

The second question also gets a "yes" answer, though somewhat less resounding. At the margin defined by the large U.S. and German global competitors, it's hard to detect differences between the rates of R&D investment sufficient to support the hypothesis that the German companies are systematically less R&D intensive (particularly if the pharmaceutical sector is excluded from the comparison). This result is hardly surprising, since these companies compete in many of the same markets. Indeed, it is just as plausible to think of them as international companies rather than as American, German, or Swiss firms. In this regard, it is interesting to note that Novartis moved its

Institutes for BioMedical Research to Cambridge, Massachusetts, in 2002 to take advantage of the critical mass of researchers.

While we have focused on intangibles, there are other differences between the German and American companies in our sample. German firms tend to have

- a larger fraction of market capitalization explained by conventional equity, even before own-intangibles are counted
- a lower return on equity, before and after own-intangibles, and
- higher debt-equity ratios

One implication is that companies are far less leveraged when all the assets are counted, a noteworthy point in view of the importance attached to leverage in the recent financial crisis and sharp recession. The lower return on equity is of some relevance for antitrust policy, since the intangibles-adjusted rate is considerably lower than the conventionally reported measure (as in Clarkson (1977)).

These differences might be explained by different corporate governance structures, or they may be a response to different economic constraints, but, in any case, they are a reminder that international comparisons are always tricky affairs. Policy inferences based on such comparisons must be treated with caution. That said, the "unsurprising" nature of the main result - that R&D investment rates for companies like BASF, Bayer, Novartis, and Siemens appear roughty similar to U.S. competitors in the global market – does suggest that a national innovation policy needs to be somewhat more nuanced than simply prescribing a fixed average target rate of R&D investment for the economy as a whole. Market-sector R&D and its co-investments are components of the overall business models of individual companies and reflect their judgments about competitive strategy. Specific spending targets may be perfectly appropriate for infrastructural investments in basic research and education, but other policies may well be more relevant for the private end of the innovation spectrum, like creating the right

economic environment based on the models provided by companies that have successfully met the challenges of the global marketplace.

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Table 1

Rates of Investment of Tangible and Intangible Capital, and Components of Intangible Investment, 2006 (% GDP)

	Tangible Investment	Intangible Investment	R&D	Innovative Property	Software	Economic Competency
United States	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
France	8.11	7.90	1.30	3.18	1.42	3.30
United Kingdom	7.04	10.54	1.07	3.16	1.55	5.84

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

Table 2

Sources of the Growth in Output per Worker Hour in the Market Sectors of the U.S., Germany, France and the U.K.,1995-2006, (%)

	Output/Labor[1]	Intangibles[2]	ITC Capital[2]	Non-ITC Tangibles[2]	Labor Comp.[2]	TFP[2]
United States	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
France	2.00	0.24	0.06	0.16	0.20	0.35
United Kingdom	3.06	0.23	0.21	0.09	0.07	0.40

Source: van Ark, Hao, Corrado, Hulten (2009).
Notes: [1] Average Annual Growth Rates. [2] Percentage share of the growth rate of output per hour.

Table 3

German+ Companies in G-12 Sample
(Rank in 100 World Top R&D Spenders)

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)

Notes: 1. Bayer Schering Pharma AG, listed on the Standard and Poors's list on rank 74, is a subsidiary of Bayer AG within the subgroup Bayer Health Care. As Bayer Schering Pharma AG is fully owned by Bayer AG, the stocks are not traded at the stock separately and own annual reports are not published. Hence, we cannot differentiate between Bayer AG and Bayer Schering Pharma AG in our analysis.
2. The ranking is for 2006 from Spectrum's Top R&D Spenders.

Table 4
"New View" Income Statement[1]
Based on 12 Company Average
2008 (€ millions)

	Trad.[2]	+R&D[2]	+Org C.[2]
1. Conventional Revenue	44,194	44,194	44,194
2. Own Production of R&D[3]	0	2,553	2,553
3. Own Production of Org. Cap.[3]	0	0	1,735
4. Total Adjusted Revenue (L1+L2+L3)	44,194	46,747	48,481
5. Conventional Cost of Revenue	31,355	31,355	31,355
6. Current Cost R&D[4]	2,093	2,093	2,093
7. Current Cost of SG&A[4]	4,721	4,721	4,721
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[5]	2,566	2,566	2,566
11. Amortization of Own R&D[6]	0	2,320	2,320
12. Amortization of Own Org. Cap.[6]	0	0	1,561
13. Adj. Operating Surplus (L9-L10-L11-L12)	3,460	3,693	3,866
14. Net Interest and Other Adjustments	-451	-451	-451
15. Before-Tax Income (L13-L14)	3,009	3,242	3,415
16. Income Tax Paid[7]	875	875	875
17. After-Tax Income	2,393	2,626	2,799
18. Earings per Share	3.34	3.67	3.91

Note 1: Based on annual reports and authors' calculations. Details may not add up due to rounding error.
Note 2: Column 1, designated "traditional", contains conventional financial data from annual reports; Column 2, designated "+R&D", adds R&D data to the data of column 1; Column 3, designated "+ Org Capital", adds organizational capital data to column 2.
Note 3: "Own Production of R&D" is the shadow value of the investment in R&D made by the company. It is equal to current cost of R&D on line 6, all of which is considered to be a capital expenditure, plus markup for profit (imputed fraction of line 9 attributable to production of R&D). "Own Production of Org. Capital" is the shadow value of the investment in organizational capital made by the company. It is equal to approximately 30% of current SG&A costs on line 7, the portion considered to be a capital expenditure, plus markup for profit (imputed fraction of line 9 attributable to production of organizational capital).
Note 4: Current cost of R&D (line 6) and organizational capital (line 7) is the outlay for labor and materials, plus applicable depreciation and amortization. This differs from the shadow values on lines 3 and 4 (see note 3).
Note 5: Conventional Depreciation and amortization are allocated to costs on lines 5 to 7. They are subtracted, here, in order to arrive at net income.
Note 6: The amortization of own R&D and organizational capital arises when these items are capitalized, as in columns 2 and 3. R&D is amortized over a 10 year useful life with a quasi-hyperbolic write-off pattern. Organizational capital is amortized over a 5 year useful life with a quasi-hyperbolic write-off pattern.
Note 7: Assumes that the implicit income from R&D and organizational capital is not taxed.

Table 5
"New View" Balance Sheet[1]
Based on 12 Company Average
2008 (€ millions)

CONVENTIONAL BALANCE SHEET[2]	Trad.[3]	+R&D[3]	+Org C.[3]
1. Current Assets	24,885	24,885	24,885
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
ADJUSTMENTS FOR OWN INTANGIBLES			
9. R&D capital[4]	0	17,208	17,208
10. Organizational Capital[4]	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
COMPANY VALUATION			
13. Market Value of Equities[5]	38,402	38,402	38,402
14. Financial Value of Firm (L13+L7)[6]	80,200	80,200	80,200
15. Core Finan. Value of Firm (L14-L1-L5)	38,413	38,413	38,413
16. Core Assets (L11-L1-L5)	18,230	35,438	42,017
17. Total Intangible Assets (L3+L4+L9+L10)	9,551	26,758	33,338
VALUATION RATIOS			
18. Tobin's equity Qe (L13/L12)	2.11	1.08	0.91
19. Percent MV Value Explained (1/Qe)	0.47	0.92	1.09

Note 1: Based on annual reports and authors' calculations. Details may not add up due to rounding error.
Note 2: Conventional balance sheet items recorded at historical cost.
Note 4: See note 2 of Table 1
Note 4: See note 2 of Table 1 for amortization assumptions. Note also that valuation of intangibles is at current, not historical, cost.
Note 5: Average monthly market value of outstanding equities.
Note 6: Average monthly market value of outstanding equities plus balance sheet liabilities.

Table 6

Comparison of Key Statistics from
the U.S. and German Firm Analysis, 2008

2008	*US-633*	*US-18*	*Ger-12*
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	0.54
%MV explained w Intan	0.77	0.80	1.17
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

Note: The US-633 sample includes 633 R&D intensive firms from Hulten and Hao (2008) updated to 2008. The US-18 sample includes: Oracle, Apple Computer, Intel, IBM, Hewlett Packard, Cisco, EMC, Johnson & Johnson, Pfizer, ABT, Bristol Myers, Eli Lilly, Wyeth, Forrest, General Electric, United Technologies, DuPont, and Dow. The German+ sample includes Adidas, Audi, BASF, Bayer, BMW, Daimler, Merck, Novartis, SAP, Siemens, Stada and Volkswagen.

Table 7

Comparison of U.S. and German
IT and Pharmaceutical Companies, 2008

	IT[1]		PHARMA[2]	
	U.S.	GERMANY	U.S.	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.

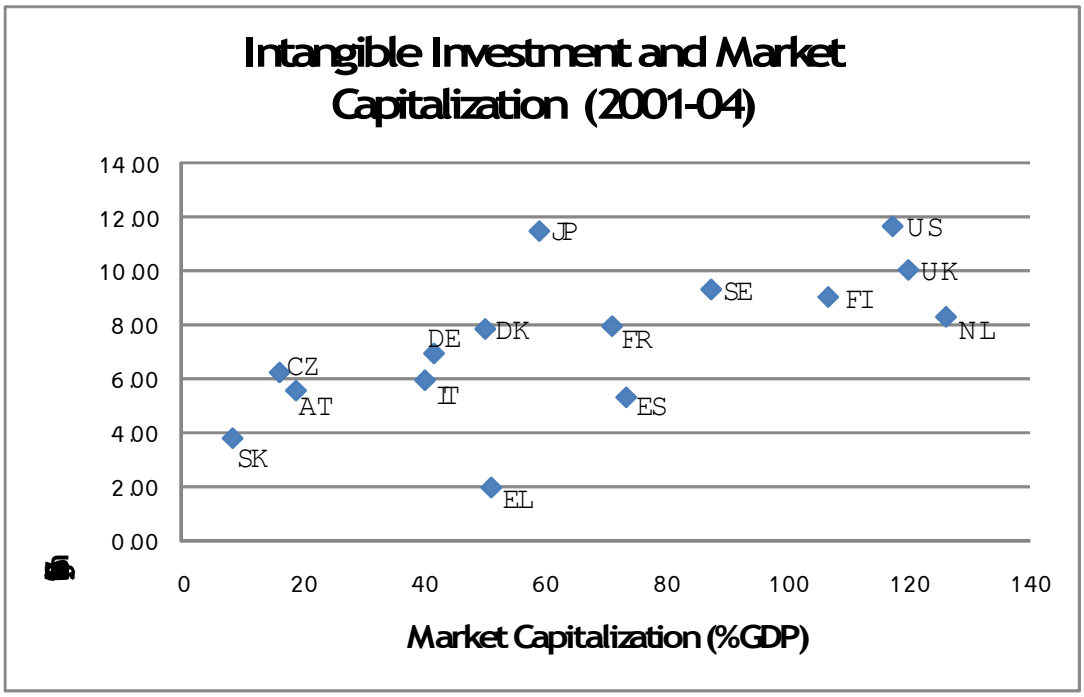
Table 8

Six Group-wise Comparisons of Companies
by Industry, 2008

	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**

Source: Compustat and annual reports of various companies.

Figure 1



Source: van Ark, Hao, Corrado, Hulten (2009) Figure 7a.
Note: Market capitalization is the value of stock market as a percentage of GDP.

Appendix
Differences between IFRS and US GAAP

The accounting environment has experienced many transformations during the last decade as a result of European regulations and changes in capital markets. The globalization of business activities and thus the increasing demand in capital has triggered the demand for timely and decision-useful investor information and thus for adjusted reporting systems. German companies participated increasingly in international capital markets, such as the New York Stock Exchange (NYSE) since the early 1990s. At that time, all German firms prepared their financial statements according to the German Commercial Code (HGB – Handelsgesetzbuch) which was not known and not accepted outside of Germany. In this context, international accounting standards became relevant for German companies. For example, to be listed at the NYSE, German corporations were to prepare their financial reports in accordance with US GAAP. Among all German companies, the Daimler Benz AG was the first German company who prepared additional financial information according to US GAAP to be listed at the NYSE in 1993[10].

Long before the European Commission has made IFRS[11] mandatory for consolidated financial statements of publicly traded companies in the European Union from 2005 onwards, the German legislation has opened up its accounting system to internationally accepted accounting standards to meet the demands of German capital market oriented firms. Amongst others, UN (2006) and Weißenberger et al. (2004) report that an increasing number of listed German companies published their financial statements according to international reporting systems, namely US GAAP or IFRS (respectively IAS before the renaming of IAS in IFRS) since 1993[12]. Already 20 per cent of the 30 companies listed at the German DAX-30[13] published their financial statements

[10] Daimler-Benz AG prepared its consolidated statement in accordance with the German Commercial Code until 1995. For the listing at the NYSE and the required Form 20-F, an additional reconciliation of net income and stockholders' equity to values under U.S. GAAP was necessary 1993-1995. Financial statements were prepared entirely in accordance with US GAAP for the first time in 1996.

[11] At that time, International Financial Reporting Standards (IFRS) were known by the older name of International Accounting Standards (IAS). The board of the International Accounting Standards Committee (IASC) has issued IAS between 1973 and 2001. The International Accounting Standards Board (IASB) adopted all International Accounting Standards in April 2001 and continued their development, calling the new standards IFRS.

[12] Parallel and dual accounting was possible before 1998. Parallel reporting: companies prepared financial statements according to IFRS or US GAAP in addition to German GAAP reports. Dual reporting: Financial reports fulfilled simultaneously the requirements of the international and German GAAP (Gassen and Sellhorn, 2006).

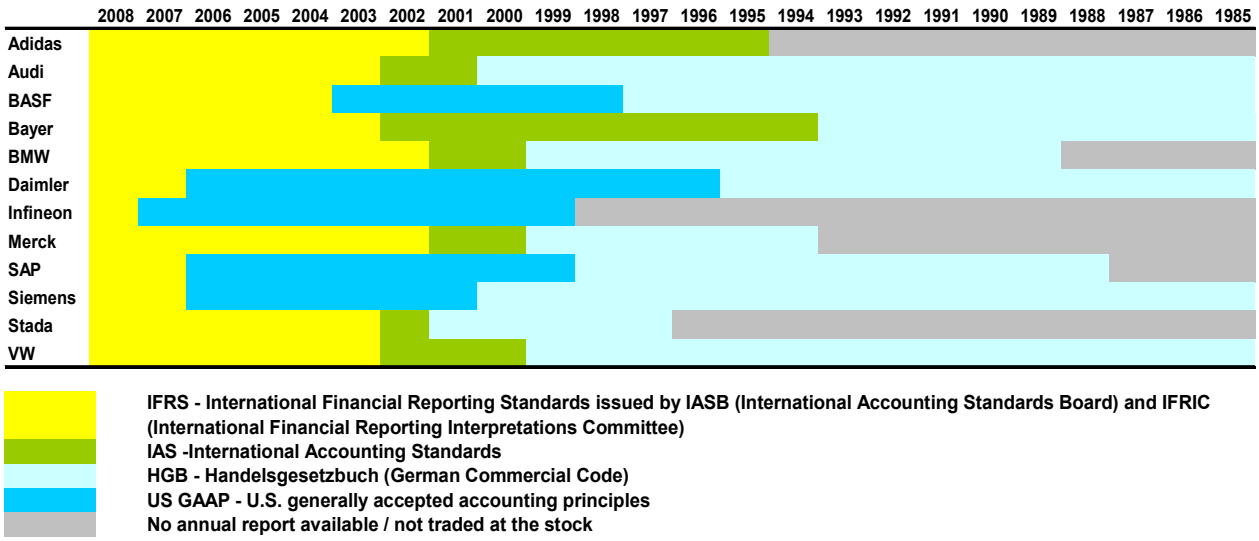
[13] DAX-30: Deutscher Aktienindex / German stock index: blue chip stock market index consisting of the 30 major German companies trading on the Frankfurt Stock Exchange. It measures the performance of the Prime Standard's 30 largest German companies in terms of order book volume and market capitalization. 9

according to IAS, and further 10 per cent in accordance with US-GAAP in 1997. The German legislator approved this practice and allowed listed companies to prepare consolidated financial statements in accordance with internationally accepted accounting standards only, either IAS or US GAAP in accordance with German GAAP in 1998 (§ 292a HGB). IAS tended to be closer to German GAAP compared to US-GAAP at that time, providing more accounting options. Thus, the majority of German companies who converted towards an international GAAP in the mid 1990s applied IAS / IFRS instead of US GAAP.

Figure 1 shows the accounting standards that were applied by the 12 German sample companies of this paper from 1985-2008. The developments described above are clearly visible when we compare the timelines. Seven out of 12 companies adopted IFRS before it became mandatory in 2005, and only 5 companies have chosen US GAAP. Even though IFRS were introduced within the European Union in 2005, Member States were allowed to defer the mandatory application of IFRS until 2007 for companies that either apply other international accepted accounting standards due to a listing outside the European Union or list debt securities only. The exemption from the latter rule until 2007 could have been applied by companies such as Siemens AG, Infineon Technologies AG, SAP AG, and Daimler AG because they are listed on the NYSE and thus prefer to prepare their financial reports under US GAAP.

out of our 12 sample companies are constituents of the DAX-30 (Adidas AG, BASF SE, Bayer AG, BMW AG, Daimler AG, Merck KGaA, SAP AG, Siemens AG, Volkswagen AG)

Figure A.1: Accounting standards of financial statements of 12 sample companies



Treatment of Intangibles under US GAAP and IFRS

For the aim of our paper, the different treatment of intangibles, especially research and development costs, under US GAAP and IFRS is of special interest, as it affects directly the main question of the paper: how much of the market-to-book value puzzle can be explained by the inclusion of internally generated intangible assets on corporate financial statements.

Many publications, such as Deloitte (2008), KPMG (2008), or PWC (2008) summarize differences and similarities between US GAAP and IFRS. The recognition and measurement of intangible assets could differ significantly under IFRS compared to US GAAP. US GAAP requires all costs related to research and development to be expensed as they incurred. Therefore, the fair value of in-process R&D needs to be determined and expensed immediately. There are only a few exceptions where different rules apply and US GAAP prohibits the capitalization of development costs. For example, costs related to the development of software for internal use or to software for sale to third parties are recognized initially at cost, but there are different thresholds for when capitalization commences. A revaluation of intangible assets is also prohibited under US GAAP.

IFRS differentiates between research and development costs. According to IAS 38, all expenses related to research are expensed in full in the period in which they incurred. Development costs that initially are recognized as expenses cannot be capitalized in a subsequent period. Development costs are capitalized if, and only if, specified narrowly defined criteria are met:

- Development cost can be measured reliably
- Intention and technical feasibility of completing the intangible asset
- Ability to use or sell the intangible asset
- Future economic benefits are probable (external use: existence of a market for the output has to be demonstrated or; internal use, usefulness of the intangible asset has to be demonstrated).

The capitalization and amortization of certain development costs under IFRS addresses the absence of many internally generated intangibles on corporate financial accounts and consequences explained in the introduction. It is a step into the right direction as the discrepancy between the market and book value decreases. Nevertheless, the conditions for capitalization of these expenses are often not satisfied in reality in full, and development costs are mostly expensed as incurred. The success of development projects is often uncertain and subject to approval procedures. The requirements of IAS 38 are seldom fulfilled and development costs are not capitalized in the pharmaceutical sector due the high level of risk up to the time pharmaceutical products are marketed. Amongst the 12 German sample companies, the automobile companies had the highest share of capitalized development cost in all research and development costs.

Table A.1 from KPMG (2008) summarizes equal and different treatment of Intangible Assets under IFRS and US GAAP. Other areas with selected major differences between those two accounting principles are shown in Appendix 2: Inventory, Property Plant Equipment, and Impairment of Assets.

Table A.1: Treatment of intangible assets under US GAAP and IFRS (IAS 38)

IFRS	US GAAP
• An intangible asset is an identifiable non-monetary asset without physical substance. • An intangible asset is identifiable if it is separable or arises from contractual or legal rights. • Intangible assets generally are recognised initially at cost, which is the fair value of the consideration given. • Goodwill is recognised only in a business combination and is measured as a residual. • Acquired goodwill and other intangible assets with indefinite useful lives are not amortised, but instead are subject to impairment testing at least annually. • Intangible assets with finite useful lives are amortised over their expected useful lives. • Subsequent expenditure on an intangible asset is capitalised only if the definition of an intangible asset and the recognition criteria are met. • Intangible assets may be revalued to fair value only if there is an active market. • Internal research expenditure is expensed as incurred. Internal development expenditure is capitalised if specific criteria are met. These capitalisation criteria are applied to all internally developed intangible assets. • Advertising and promotional expenditure is expensed as incurred. • Expenditure on relocation or reorganisation is expensed as incurred. • The following costs cannot be capitalised as intangible assets: internally generated goodwill, costs to develop customer lists, start-up costs and training costs.	• Like IFRSs, an intangible asset is an asset, not including a financial asset, that lacks physical substance. • IFRSs, an intangible asset is identifiable if it is separable or arises from contractual or legal rights. • Like IFRSs, direct-response advertising, software developed for internal use, and software developed for sale to third parties are recognised initially at cost. • Other Intangible assets generally are recognised at fair value, which usually equals the fair value of the consideration given, like IFRSs. • Like IFRSs, goodwill is recognised only in a business combination and is measured as a residual. • IFRSs, acquired goodwill and other intangible assets with indefinite lives are not amortised, but instead are subject to impairment testing at least annually. • Like IFRSs, intangible assets with finite lives are amortised over their expected useful lives. • Subsequent expenditure on an intangible asset is not capitalised unless it can be demonstrated that the expenditure increases the utility of the asset, which broadly is like IFRSs. • Unlike IFRSs, intangible assets cannot be revalued. • Unlike IFRSs, both internal R&D expenditure is expensed as incurred. Special capitalisation criteria apply to direct-response advertising, software developed for internal use, and software developed for sale to third parties, which differ from the general criteria under IFRSs. • Unlike IFRSs, direct-response advertising expenditure is capitalised if specific criteria are met. Other advertising and promotional expenditure is expensed as incurred, like IFRSs. • IFRSs, certain relocation costs following a business combination are capitalised. Other relocation or reorganisation expenditures are expensed as incurred, like IFRSs. • Like IFRSs, the following costs cannot be capitalised as intangible assets: internally generated goodwill, costs to develop customer lists, start-up costs and training costs.

Source: KPMG (2008): IFRS compared to U.S. GAAP: An overview.

2. Other selected Areas with significant differences US GAAP - IFRS

Table A.2: Treatment of Inventory under US GAAP and IFRS (IAS 2)

IFRS	US GAAP
• Generally inventories are measured at the lower of cost and net realisable value. • Cost includes all direct expenditure to get inventory ready for sale, including attributable overheads. • Decommissioning and restoration costs incurred through the production of inventory are included in the cost of that inventory. • The cost of inventory generally is determined using the FIFO (first-in, first-out) or weighted average cost method. The use of the LIFO (last-in, first-out) method is prohibited. • Other cost formulas, such as the standard cost or retail method, may be used if the result approximates actual cost. • The same cost formula is applied to all inventories having a similar nature and use to the entity. • Net realisable value is the estimated selling price less the estimated costs of completion and sale.	• Unlike IFRSs, generally inventories are measured at the lower of cost and market. • Like IFRSs, cost includes all direct expenditure to get inventory ready for sale, including attributable overheads. • Unlike IFRSs, asset retirement obligations incurred through the production of inventory are added to the carrying amount of the related item of property, plant and equipment. • Unlike IFRSs, the cost of inventory can be determined using the LIFO method in addition to the FIFO or weighted average method. • Like IFRSs, the standard cost or retail method may be used if the result approximates actual cost. • Unlike IFRSs, the same cost formula need not be applied to all inventories having a similar nature and use to the entity. • Unlike IFRSs, “market” is replacement cost limited by net realisable value (ceiling) and net realisable value less a normal profit margin (floor). Like IFRSs, net realisable value is the estimated selling price less the estimated costs of completion and sale.

Source: KPMG (2008): IFRS compared to U.S. GAAP: An overview

Table A.3: Treatment of Property, Plant, and Equipment under US GAAP and IFRS (IAS 16)

IFRS	US GAAP
• *Property, plant and equipment is recognised initially at cost.* • *Cost includes all expenditure directly attributable to bringing the asset to the location and working condition for its intended use.* • *Cost includes the cost of dismantling and removing the asset and restoring the site.* • *Changes to an existing decommissioning or restoration obligation generally are added to or deducted from the cost of the related asset and depreciated prospectively over its remaining useful life.* • *Property, plant and equipment is depreciated over its useful life.* • *An item of property, plant and equipment is depreciated even if it is idle, but not if it is held for sale.* • *Property, plant and equipment may be revalued to fair value if fair value can be measured reliably.*	• *Like IFRSs, property, plant and equipment is recognized initially at cost.* • *Like IFRSs, cost includes all expenditure directly attributable to bringing the asset to the location and working condition for its intended use.* • *Like IFRSs, cost includes the cost of dismantling and removing the asset and restoring the site.* • *Like IFRSs, changes to an existing decommissioning or restoration obligation generally are added to or deducted from the cost of the related asset and depreciated prospectively over its remaining useful life.* • *Like IFRSs, property, plant and equipment is depreciated over its useful life.* • *Like IFRSs, an item of property, plant and equipment is depreciated even if it is idle, but not if it is held for sale.* • *Unlike IFRSs, estimates of useful life and residual value, and the method of depreciation, are reviewed only when events or changes in circumstances indicate that the current estimates or depreciation method no longer are appropriate.* • *Unlike IFRSs, component accounting is permitted but not required.* • *Unlike IFRSs, the revaluation of property, plant and equipment is not permitted.*

Source: KPMG (2008): IFRS compared to U.S. GAAP: An overview

Table A.4: Treatment of Impairment of Assets under US GAAP and IFRS (IAS 36)

IFRS	US GAAP
• The impairment standard deals with the impairment of a variety of non-financial assets, including property, plant and equipment, intangible assets and goodwill; investment property and biological assets carried at cost less accumulated depreciation; and investments in subsidiaries, joint ventures and associates. • Impairment testing is required when there is an indicator of impairment. • Annual impairment testing is required for goodwill, and intangible assets that either are not yet available for use or have an indefinite useful life. This impairment test may be performed at any time during an annual reporting period provided that it is performed at the same time each year. • Goodwill is allocated to cash-generating units (CGUs) or groups of CGUs that are expected to benefit from the synergies of the business combination from which it arose. • A CGU is the smallest group of assets that generates cash inflows from continuing use that largely are independent of the cash inflows of other assets or groups thereof. • Whenever possible an impairment test is performed for an individual asset. Otherwise assets are tested for impairment in CGUs. Goodwill always is tested for impairment at the level of a CGU or a group of CGUs.	• Unlike IFRSs, goodwill is allocated to reporting units (RUs) that are expected to benefit from the synergies of the business combination from which it arose. • Unlike IFRSs, an RU is defined as an operating segment or one level below an operating segment. • Unlike IFRSs, an asset group is the lowest level for which there are identifiable cash flows that largely are independent of the cash flows (rather than cash inflows) of other groups of assets. • Unlike IFRSs, the carrying amount of goodwill is not grossed up for impairment testing if minority interests are present. • Unlike IFRSs, an impairment loss is recognized for assets other than goodwill and identifiable intangibles with indefinite lives only if the asset's (asset group's) carrying amount is less than the undiscounted cash flows of the asset or asset group. The impairment loss is calculated based on the fair value of the asset (asset group), unlike IFRSs. Unlike IFRSs, an impairment loss is recognized for goodwill if the fair value of the RU is less than its carrying amount, and for an indefinite lived identifiable intangible asset if its fair value is less than its carrying amount. • Unlike IFRSs, the cash flows used to assess recoverability are not discounted. • Unlike IFRSs, an impairment loss for an asset group is allocated pro rata to assets in the asset group, which excludes goodwill, corporate assets and indefinite-lived intangible assets. • Unlike IFRSs, the revaluation of property, plant and equipment and intangible assets is not permitted; therefore all impairment losses are recognized in profit or loss. • Unlike IFRSs, reversals of impairments are prohibited.

Source: KPMG (2008): IFRS compared to U.S. GAAP: An overview