Preliminary and Incomplete

Extending Firm Surveys to Measure Intangibles: Evidence from the United Kingdom and United States[1]

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Abstract
Conventional wisdom is that (a) data on business intangible spending would be extremely useful, but (b) it is too difficult. Demand to take some sort of measurement stand has been given impetus by, for example, the decision to capitalize software and R&D in the national accounts and the highly influential recent works of Corrado, Hulten and Sichel (2004, 2006), Nakamura (2001), and Lev (2001). However, the supply of good measures of these intangibles has lagged somewhat behind the demand for their inclusion. The purpose of this paper is to triangulate new survey data piloted in the United Kingdom and the United States with past measurement assumptions. Our results have implications for future data collection efforts.

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I. Introduction

Exploratory but provocative recent evidence suggests that a critical component of productivity growth is the growth in intangible capital. Corrado, Hulten and Sichel (2006) (hereafter CHS) argue that the overall capital stock of the U.S. in the late 1990s is increased by about $3.6 trillion dollars when the intangible capital stock is included. Moreover, they find that the growth of intangible capital has outpaced the growth of tangible capital over the last couple of decades. CHS (2006) take a broad view of intangible capital in their paper, which we also adopt in this paper. Under this broad view, intangible investments are defined as expenditures and activity by businesses in the current year (other than for tangible assets) that are not for the production of goods and services to be sold in the current year but instead to enhance the products and/or processes for production in future years.

Existing surveys of business activity are not able to quantify the full extent of these activities. The problem is not so much that there are unmeasured expenditures of businesses but rather the allocation of business expenditures for current operating expenses relative to intangible capital investment. For example, a substantial fraction of management time may be devoted not to current production but to planning for the future. Capturing this activity in surveys requires asking questions about the allocation of time and resources devoted towards future production. This measurement challenge is present for all businesses but likely is of particular importance for highly innovative industries as well as for young businesses. By their very nature, young businesses are likely devoting substantial amount of their time and resources to intangible investment. So some, but not all, of our focus is on intangible capital investment by young businesses.

Measuring the contribution of intangible investment for businesses requires adding new questions to surveys on businesses, as well as addressing challenging measurement questions such as how to value expenditures on intangible investment and how to depreciate the accumulation of intangible capital. For the latter, it is essential that the firm growth, entry and exit dynamics be accurately tracked and that conceptual issues about the implications of firm exit for depreciation be resolved.

Much of the measurement literature on intangible capital (see, e.g., Corrado, Haltiwanger and Sichel (2004)) is exploratory.[2] There has been relatively little research devoted to developing economy-wide measures of intangible capital investment. A key exception is the recent work by CHS mentioned above. The CHS analysis is highly exploratory with many very strong assumptions made given the paucity of data. In our view, their work should be viewed a blueprint for how to think about and measure intangible capital, as well as the first attempt to implement their approach. Their work draws on a myriad of sources, but they make it clear that there are large current measurement gaps for implementing their approach. For example, the measure of organizational capital spending by firms on new managerial processes assumed that 20% of managerial time was spent building such capital. This figure involves, as the authors acknowledge, a rather high ratio of assumption to fact, given the paucity of available data on managerial time use. Our paper attempts to make progress in filling this measurement gap.

This paper proceeds as follows. In section II, we provide an overview of the CHS approach and the challenges for economics measurement. In section III, we

[2] The accounting literature is perhaps more settled in that accountants have established a range of conventions for spending measurement and depreciation but without a systematic approach to the economic characteristics of assets and their value.

describe ongoing efforts in the U.S. and the U.K. to make progress on these measurement challenges. Specifically, we discuss efforts to measure intangible capital expenditures in the Kauffman Firm Survey (that focuses on new and young businesses) as well as on efforts in the U.K. to add questions to existing Innovation and R&D surveys. These efforts are very recent (including surveys in the field in 2009) so the results are highly preliminary. Still, our findings begin to offer a characterization of the challenges to measuring intangible capital as well as to the importance of various sub-categories. In the last section, we have concluding remarks.

II. Conceptual Underpinnings and Measurement Challenges for the CHS Approach

The approach advocated by CHS is to treat intangible capital like tangible capital – specifically, to measure intangible capital stocks using a perpetual inventory method. This implies that intangible capital in the current period (total or of a specific type of intangible capital) is equal to the discounted sum of real intangible capital investments in prior years. The discount factor used is based on a depreciation rate for intangible capital. This implies three key measurement requirements. First, the expenditures on intangible capital by asset type must be measured. Second, a price deflator for intangible assets must be measured to convert nominal expenditures into real expenditures. Third, a depreciation rate by asset type must be measured. Each of these poses substantial challenges – for all businesses but especially for young businesses.[3]

[3] Underlying this is of course a fourth challenge, that is to settle on an admissible list of intangible assets.

CHS use a myriad of sources to measure expenditures on intangible capital given the current measurement gaps. A core part of the CHS measurement effort is from surveys that attempt to measure scientific and non-scientific R&D expenditures. Other components of their effort reflect attempts to measure the contribution of improved use of information technology (other than that captured by software expenditures), brand equity and other investment by firms. It is apparent that R&D Expenditures as measured by existing surveys (such as the Industrial R&D Survey or the Service Annual Surveys that can be used to measure non-Scientific R&D) don't capture the full extent of expenditures on intangible capital. Some of this is by design since, for example, the focus is particular types of scientific R&D. However, even if by design, the findings of CHS highlight a measurement gap in current statistics for the U.S., the U.K. and other countries.

For price deflators, we know from tangible assets this is a challenge for many asset types given changes in capital quality (e.g., the rapid increase in the quality of computers over time). These problems are also likely a substantial challenge for intangible assets. CHS take the approach of using output price deflators as a placeholder while others have used input price deflators. This issue remains an open area for future study that this paper does not directly address. The use of the output and input price deflators used in the literature is likely a good starting point.

Turning to the depreciation rate, we know this should reflect the service life of the asset as well as the obsolescence and secondary markets for assets. One challenge for depreciation rates even for tangible assets is the role of business exit. In the standard approach in the national accounts, the presumption is that the tangible assets (e.g., fixed plant and equipment) of the business are sold on

secondary markets if the business shuts down. Depreciation rate schedules for tangible assets have been developed that take into account the nature of these secondary markets. While there are open questions about the nature of secondary markets for tangible assets, it is even less clear that the presumption of secondary markets is appropriate for intangible assets.

All of these measurement challenges are that much more difficult for young businesses. First, since many young businesses are small, they have less formal job tasks with the business owner and coworkers doing many different tasks. Compared with large corporations that have product or process development divisions, this implies it is very difficult to measure the expenditures on such product and process development at young businesses using existing surveys. Put differently, the types of questions that are on existing surveys that ask about expenditures on product and process development are best suited to corporations who have separate divisions devoted to these activities. Second, as a recent National Academy of Sciences report emphasized (see, Haltiwanger, Lynch and Mackie (2007)), young businesses are under-represented on U.S. surveys of businesses by the federal statistical agencies. Third, the issues associated with measuring depreciation associated with business exit rates are especially relevant for young businesses. The evidence on the dynamics of young businesses is that they exhibit an "up or out" dynamic in their first ten years (see, Davis, Haltiwanger and Jarmin (2008)). That is, they have very high exit rates relative to more mature businesses but also conditional on survival they grow much faster than their more mature counterparts. Given that secondary markets for the intangible capital may be limited or even non-existent for businesses

that shutdown, this raises challenges for resolving the role of business exit for depreciation of intangible capital that are especially relevant for young businesses.

The role of exits and secondary markets is that much more challenging for intangible capital on a number of dimensions. To the extent the intangible capital is basic scientific knowledge it may have a very long service life. For basic scientific knowledge the issue may be more whether the knowledge is non-proprietary. Patents and other mechanisms are used to protect property rights for some types of such knowledge but it is important to emphasize that these are issues relevant for the measurement of intangible capital. Alternatively, to the extent that the intangible capital is "organizational capital" specific to the business, it is unclear what happens to that organizational capital if the business exits. For businesses that are acquired, the organizational capital presumably continues to have value but for businesses that shut down it is not clear that there is any secondary market of organizational capital in the same way there is for tangible assets like fixed plant and equipment. One interesting channel that some components of knowledge or organizational capital may be transferred and thus still be in service is through the business owner and/or coworkers. That is, the knowledge capital may be mostly embodied in the business owners and coworkers. Thus, tracking what happens to business owners and workers for a business that exits (and in turn what happens to the business these individuals transit to) is a way to study the extent to which the knowledge capital is embodied in the individuals.

Having reviewed the challenges to constructing a measure of the intangible capital stock, it is clear that a top priority is to measure the expenditures on intangible capital investment for businesses. Taking the broad CHS approach literally, one step

to make progress is to add intangible capital expenditure questions on firm surveys. At the core, a question or line of questions should ask about the fraction of the time that the workforce (including management time) in the current fiscal year is devoted to activities that are designed to develop products and/or processes (or improvements in the marketability of your products) for future years. Related questions should be asked about the amount of expenditures on materials or services that are designed for future year product or process development or to improve future year marketability of products.

The objective of such questions is to be able to decompose current expenditures on materials, services and payroll into the expenditures devoted to current (fiscal year) products and services and those devoted to future year products and services. The traditional approach in productivity growth accounting is to treat expenditures on materials, services and payroll as contributing only to current year production. The insight from CHS is that an important fraction of these expenditures are instead intended to contribute to products in the future. CHS point out that neglect of measuring intangible capital yields mismeasurement of productivity in terms of both outputs and inputs. On the input side, much current expenditures being devoted to intangible capital investment should be attributed to building up the intangible capital stock for future returns. In turn, the intangible capital stock itself is an output that is typically not captured under current measurement practices.

Beyond these most basic questions, further questions on surveys (and other firm level data sources) are needed to distinguish between product vs. process development, scientific vs. non-scientific development, the time spent by business owners and by different types of workers. Put differently, as with tangible capital,

there are different types of intangible capital assets with different service lives, secondary markets, and the like. CHS group intangible assets into the following categories: Computerized Information (other than software), R&D (scientific), R&D (non-scientific), Brand Equity, and Firm-Specific Resources. These categories were partly driven by data availability and need to be refined but they are a useful starting point.

In addition, consideration should be given to making the connection to other indicators of innovation. For example, questions could be asked about whether the intangible capital expenditures are designed to contribute to a patent or other measure of innovation. Alternatively, questions could be asked about changes in organizational structure of the firm (e.g., the use of teams) that have resulted from expenditures on intangible capital.

Two additional points are worth making. First, as is implicit in this description, much intangible spending will be own-account. Now, most tangible investment data relies on questionnaires asking for purchases by the firm from external suppliers of tangible investment goods. For many intangibles, this will likely understate intangible spending if it misses own-account investment.[4] Thus questionnaires will have to be carefully drafted to capture these data.

Second, asking for spending contrasts with the approach of innovation surveys which is to ask firms to self-report whether they have innovated or not and/or what fraction of their output is due to product innovations.[5] To interpret these questions

[4] UK software investment for example is 40% bought in and 60% in house.
[5] The EU Community Innovation Survey starts with such questions, split by process and product innovation and then asks to report the fraction of sales accounted for by product innovations. Some of them then ask for intangible spend, but typically do not clarify the own-account and purchased distinction.

across firms and time depends upon a clear definition of what an innovation is (and the second question misses out process innovation).

The information on expenditures on intangible capital is essential for measurement of intangible capital for businesses. Currently, there is little or no information on such expenditures. With such information, measures of intangible capital investment for businesses could be constructed. With firm level information on intangible capital expenditures along with information about firm outcomes and other activities, the role of intangible capital for growth and survival of firms could be analyzed.

The discussion in this section discusses the challenges for measuring intangible asset expenditures and constructing intangible capital stocks. As we noted in the introduction, there are new efforts underway to address these challenges. The remainder of the paper describes these new efforts and provides a preliminary assessment. It will become clear in the discussion that these new efforts are only a first step but a very useful step in providing direct evidence on intangible asset expenditures and service lives.

III. Our Contribution: A Preliminary Assessment of Efforts in the U.S. and U.K. to measure Intangible Capital Expenditures

Early efforts are underway in the U.S. and the U.K. to collect data on intangible capital expenditures in a manner broadly consistent with the CHS framework. The purpose of this paper is to describe such efforts as well as to provide a preliminary assessment of these efforts. The basic facts that emerge are of

interest in their own right as they provide some of the first direct estimates of intangible capital expenditures. In addition, we compare the findings from the new data with the assumptions CHS made in their attempts to measure intangible capital. Such comparisons both help in evaluating the CHS assumptions but also in evaluating the nature and quality of the measures from these new survey efforts.

New Survey Evidence

Four parallel efforts are underway in the U.S. and the U.K. In the U.S., new questions were added on spending on intangible assets by young firms in the longitudinal Kauffman Firm Survey (KFS). In the U.K., three efforts are underway. First, a new "Intangible Assets Survey" is recently in the field (full sample in October 2009 but pilot survey in the last year). Second, a survey, run by a team at Warwick University and Birmingham University, funded by NESTA, was run in Summer 2009 asking around 1,500 firms concentrated in aerospace, autos and services on expenditure on a number of intangible assets, namely software, marketing, R&D, design and process changes (as well as a large number of other innovation related questions). Third, the Community Innovation Survey (CIS), the UK version of the EU innovations survey, has questions that can be used to provide some quantification of expenditures on intangible capital expenditures within the CHS framework. In what follows, we discuss each of these efforts in turn with some preliminary results and analysis from these efforts.

Results from the Kauffman Firm Survey in the United States

The Kauffman Firm Survey (KFS) is a longitudinal survey of new businesses in the United States. This survey collected information on 4,928 firms that started in 2004 and surveys them annually. In addition to the 2004 baseline year data, there are three years of follow up data (2005-2007) now available. The 2008 data will be released in February, 2010. Three additional follow up surveys are planned to collect data for 2009-2011. Detailed information on the firm includes industry, physical location, employment, profits, intellectual property, and financial capital (equity and debt) used at start-up and over time. For more information about the KFS survey design and methodology, please see Robb et. al (2009). A public use dataset is available for download from the Kauffman Foundation's website and a more detailed confidential dataset is available to researchers through a data enclave provided by the National Opinion Research Center (NORC). For more details about how to access these data, please see www.kauffman.org/kfs.

The sampling frame for the KFS is based on the Dun & Bradstreet (D&B) database, which was partitioned into sampling strata defined by industrial technology categories (based on industry designation). The high and medium technology strata were defined based on categorization developed by Hadlock et al. (1991), which took into account the industry's percentage of R&D employment and classified the businesses into technology groups based on their Standard Industrialization Classification (SIC) codes. High technology businesses were oversampled. Specifically, the original sampling design called for 2,000 interviews to be completed among businesses in two categories of high-technology businesses and 3,000 interviews to be completed among businesses in all other industrial classifications.

Six-digit NAICS codes are used to identify high tech firms using more current definitions in the KFS. We classify subsets of firms in high technology industries in two ways. Following Chapple et al. (2004), we identify industries that are considered technology employers, that is, industries where employment of these occupations exceeds three times the national averages of 3.33%, or 9.98%. In addition, we identify industries that are generators of technology, which are defined by the NSF's Survey of Industrial Research and Development as industries that exceed the U.S. average for both research and development expenditures for employee ($11,972) and the proportion of full-time-equivalent R&D scientists and engineers in the industry workforce (5.9%). We classify firms as high-tech if they fall into at least one of these two categories. We analyze expenditures on intangible assets separately for high-tech firms.

While the 2004-2007 data have information on the protection of intellectual property, the sources of comparative advantage, and investments and employment in research and development, investment in intangible assets will only be available for calendar year 2008 and later. In the KFS, investments in intangible assets are defined as expenditures expected to produce long-term benefits for the business. Respondents were asked whether they made any expenditures in each of the following categories of intangible assets (the actual questions used in the KFS pilot on intangibles is in Appendix A):

- The design of new and improved products and services
- Investments in software or databases
- Brand development, such as advertising or marketing
- Organizational development such as company formation expenses or management consulting
- Worker training
- Any other intangible asset investments

Data on total expenditures were also collected and respondents were asked to also consider the cost of in-house activities in these areas, including the time of the business owner(s), as well as services or license fees from outside providers.

Preliminary 2008 data from the Kauffman Firm Survey indicate that nearly half of all firms and about two-thirds of high-tech firms invested in at least one type of intangible assets (see Table 1 left panel). These data are investments made in 2008 by firms in their fifth year of operation. (These firms began operations in 2004). Nearly 20 percent of the firms invested in the design of new products and services, while a quarter made investments in software or databases. More than one-third of firms made investments in brand development, such as advertising and marketing, while only eight percent made investments in organizational development, such as management consulting. Finally, about 20 percent of firms invested in worker training in 2008.

High-tech firms were much more likely to invest in at least one type of intangible assets and had higher incidence rates of investing in each of the different types of intangible assets. The most common type of expenditure was investment in software or databases, followed by expenditures in brand development, such as advertising and marketing. Nearly 40 percent of high-tech firms invested in the design of new and/or improved products and services, while just over a quarter of high-tech firms invested in worker training. As with all firms, the least common type of intangible assets spending was organizational development. A small fraction of firms invested in other types of intangible asset spending not otherwise specified.

Comparing the expenditures by category in Table 1 to those in CHS reveals some interesting patterns. CHS findings suggest that about 15 percent of intangible

spending is on software, about 19 percent on Scientific R&D, about 19 percent on non-scientific R&D (e.g., development on new products or processes not captured by scientific R&D), about 13 percent on brand equity and about 35 percent on firm-specific resources like worker training or management time spent on planning for future activity. The percentages from the KFS, while not directly comparable, also suggest that many of these same categories are important. Brand development seems to be more important in the KFS than found in CHS. For example, conditional on making intangible capital investments, the results in Table 1 indicate that about 70 percent make investments in brand development. Caution needs to be used in comparing with results from CHS since the results in Table 1 refer to percentage of firms engaged in the activity while CHS percentages reflect shares of actual expenditures.

Turning to Table 2, left panel, in terms of levels, firms with intangible asset spending averaged about $28,000 in investments in 2008, which was about four percent of total expenses for the year. Expenses were defined as the costs paid for the operation of the business (wages, salaries, interest on loans, capital leases, materials, etc.). High-tech firms invested more than $100,000 in intangible assets in 2008, or about 12 percent of total expenses.

For purposes of comparison, CHS estimate that intangible investment expenditures account for about 10 percent of business output. While this is not directly comparable (as our denominator is total expenses and theirs is output), our findings suggest a somewhat smaller share of activity is being devoted to intangible capital investment. Note, however, this may reflect the difficulty firms have in breaking out the fraction of say, management time, is spent on current profits vs.

future profits. CHS make an explicit assumption about this fraction and it may be challenging to elicit such information from firms.

A related investment is spending on research and development of new products and services. Firms were asked whether they had R&D spending and what the total R&D expenses were for the year, including materials, equipment, space, salaries, wages, benefits, and consulting fees. As shown in Table 3, left panel, only about 14 percent of firms had R&D investments, while nearly half of firms invested in intangible assets. About 92 percent of firms that had R&D investments also had expenditures in intangible assets, while about a quarter of firms with intangible asset expenditures also had R&D investments. Firms with R&D spending invested about $55,000 on average. More than 92 percent of firms with R&D spending had expenditures on intangible assets. Those firms had slightly higher levels of R&D investment at $58,581.

On average, firms invested about $28,000 in intangible assets in 2008. However, those firms that had R&D investments had much higher investments in intangible assets, more than $60,000. Finally, firms that sold products had higher incidence levels as well as higher levels of both R&D expenditures and intangible asset expenditures, compared with firms that offered services.

Thus the data offers an interesting perspective on intangible spending given the emphasis on R&D. It suggests that, first, among R&D spenders, a dollar of R&D is matched by more than a dollar of (non R&D) intangible spend, suggesting that just R&D understates total intangible spending. Second, intangible spending is less badly skewed than R&D spending, that is, 76% of firms who spend on intangibles (which in turn is 50% of firms) do not spend on R&D.

Results from the NESTA Innovation Survey in the United Kingdom

The NESTA Intangible Innovation Survey (IIS) was carried out in Summer 2009. It concentrated on nine different industries (Accountancy, Aerospace and Autos, Architecture, Construction, Consulting, Energy, Legal, Software/IT, and Design) and obtained usable responses from 989 firms (see Appendix 2). Given these industries are all either R&D intensive and/or highly skilled, we did not separately allocate them to a "high technology" sector, but would, at first pass, assume the firms are easiest to compare with the High-Tech results from the KFS. The spending questions are set out in Appendix 1, but in brief they ask for spending on software, marketing, R&D, design, and business process change.

The right-hand panel of Table 1 sets out the responses, by number, to the questions. First, looking at the overall numbers, the KFS survey shows, that in their sample, top line, 48.9% of firms report some intangible spending, and 64.5% of hi-technology firms. In the NESTA survey we find 68.1% of firms reporting any intangible asset expenditures, remarkably close to the KFS hi-tech number. Turning second to the detailed spending numbers, we see similarly spending for software, but greater numbers reporting spending in the high-tech sample.

Table 2, right-hand panel, considers the spend on intangibles, in the UK data, as a percentage of turnover (sales) since we do not have data on all expenses. The overall number is smaller than the KFS Hi-Tech results, at 3% of turnover, but if expenses are smaller than turnover then this needs to be adjusted upwards to be more comparable to the KFS number.

Table 3, right hand panel, sets out the numbers by R&D spender and non-R&D intangible assets spend. As we saw in the Kauffman data, 14.2% of firms report

R&D spend. For the UK, the figure is 15.9%. Of those, in the US, 92% also spend on non-R&D intangibles: in the UK, the figure is 89.2%. The expenditure numbers for the UK are greater however, with much more spending here and below on intangibles.

Turning to the second panel down, the KFS shows that 48.9%, a larger number spent on intangible assets, of whom on 24.8% spent on R&D. In the UK, of the 68.1% who spend on intangibles, 20.8% spend on R&D, remarkably close to the US numbers. This pattern is repeated in the lower panels where the various fractions spending match the KFS data very closely indeed.

Finally, how do these numbers compare with the macro spending numbers? Table 4 sets out data on this from the UK data, and reads as follows. Column 2 shows data for the full 989 firms. One issue we encountered is that some firms are substantial spenders who influence the distribution. While it is not unusual for distribution of firm activity to be very skewed, it is useful to understand how the distribution looks with and without the big spenders. Thus, in addition to reporting the results for all firms we also report results when we removed the topmost 5% of firms (that is, we removed any firm who was in the topmost 5% of spending on any one of the intangible assets). This then left us with 875 firms. In each of these two rows we then report the fraction of all intangible spending accounted for by the particular intangible asset set out in the row. As the table shows, the spending profile is rather influenced by the big spenders, with business process change expenditure particularly large in the initial sample.

The final column gives the fractions from the macro data. These fractions are for as similar industries as we can find, (manufacturing, construction and financial &

business services) in the macro data. One category that does depend upon sample chosen is process change expenditure which the full sample suggests that the macro data overstates but the smaller sample suggests and understatement. Of course, the numbers are not weighted to be representative so comparisons should be made with caution, but the broad similarity between the micro and macro samples is worth noting.

Results from the Intangibles Assets Survey in the United Kingdom

Another effort underway in the U.K. is the new "Intangible Assets Survey". This new survey is an extended R&D survey. This survey extended the official R&D survey by asking about spending on a range of intangible assets beyond R&D spend, namely software, design, marketing, training and organizational capital (these extra categories were designed to match the CHS headings). This survey also asked about service lives for these different types of assets. The CHS method, like any capitalization method, requires depreciation/service lives. For many intangible assets these are based on assumption rather than hard data. Thus, firms were asked to estimate how long their particular intangible asset building projects yielded productive services.

This new survey is very recent. A pilot survey on 38 firms was administered by face-to-face interviews between October 2008 and March 2009 by Office of National Statistics (ONS) staff. The sample was drawn from the innovation survey (see below) universe. One focus of the new survey is to sample firms who were not sent the R&D survey (financial services firms for example). While the sample is

small, a pilot was needed to better develop the questionnaire, and the initial results are of interest, given the paucity of data on the question.

Second, following the securing of further funding, the survey was then administered to around 2,500 firms in October 2009. That sample was drawn from the business register and so we should have weights to try to get statistical representativeness. In addition, the survey is an official ONS survey, which should boost response rates.

Currently, we have responses from 725 firms. Disclosure prevents us from reporting, at this stage comparable tables to those results above on spending, but we do have some results on life lengths. Regarding spending, we were able to confirm the broad patterns in Table 3 above. That is, of those firms who reported R&D a similar number also reported spending on (non-R&D) intangible assets. In addition, of those firms who reported spending on (non-R&D) intangible assets a smaller number reported spending on R&D.

Turning to life lengths of intangible assets, as background, there are two main assumptions in the literature on depreciation rates. The first, is around 15% for R&D, which seems to have become somewhat an industry standard and the second is the set of deprecation assumptions used by CHS in their intangible work, almost all of which are 33%, following the industry standard for software. Assuming a straight line depreciation, the life length is then the reciprocal of the deprecation rate, which is 3 years for software and other intangible assets and 6.67 years for R&D.

To shed light on these assumptions, the IAS questionnaire asks for “life lengths” as follows. For each asset category, we asked “on average, how long does the business expect to benefit from a typical investment in

training/software/reputation and branding/R&D/design/organization or business process improvement" (that is 7 different questions for the 7 assets). Table 5 provides data on average length of life in months, with the average taken over all those reporting a positive benefit life.

The data show patterns roughly consistent with the CHS assumptions. For example, the service lives for the non-R&D assets being around 2-4 years. The R&D number is somewhat higher than the CHS assumptions, at about 4½ years, which is below the 6.67 year assumption. When fuller data are available, these numbers can be reported for High-tech and other industries where there might be some interesting variation.

We note however that these estimates don't capture any of the impact of business dynamics (exit) or spillover effects that may influence the appropriate calculation of depreciation rates in the manner discussed in section II.

Results from the CIS in the U.K.

The final survey we consider is the Community Innovation Survey (CIS). The CIS is a European wide survey on innovation. After asking a series of questions on whether the firm has innovated or not (yes/no) and fractions of sales due to new product innovations, the survey asks about spending on a number of different innovation assets. These spending questions are on R&D, software, design, marketing and training. Thus, they are of interest since they are about a number of the intangible assets identified by CHS. As we discuss, they are however not at all detailed about the own-account versus purchased split.

Our analysis of the CIS data is at a very preliminary stage of analysis. Nevertheless, the preliminary findings suggest some stark differences with the CHS assumptions and findings. On all categories the implied spending in the CIS is very much lower than that found CHS, sometimes by a factor of 13. We are concerned however, that this may be due to question design. First, the intangible spending questions have low response rates (they have improved in the most recent wave). Second, the question on software asks for hardware to be included. Third, the questions do not ask firms to distinguish between own account and purchased and are rather ambiguous in their phrasing. Fourth, the questions ask firms to report spending only insofar as it relates to their innovation. But innovation is self-reported and not clearly defined.

IV. Conclusion

We regard this as a first step in moving towards better measures of intangible assets. These new survey efforts we discuss here could provide useful templates for future surveys in the United Kingdom and United States, as well as surveys in other countries. Even at this early stage we see the following tentative conclusions.

First, R&D is but one measure of knowledge investment. In all samples considered here, almost all firms who invested in R&D also invested other non-R&D intangible spend. Conversely, of all firms who invested in non-R&D intangible spend, only a fraction invested in R&D. Thus to study only the R&D performers without intangible spending misses, on that sample, a good deal of coinvestment with the R&D and the sample itself misses much knowledge spending.

Second, we have, we believe, some interesting evidence on intangible asset lives, suggesting that non–R&D lives are somewhat shorter that R&D lives and that a depreciation rate of 33%, assumed by CHS, is by no means a bad starting point.

Table 1: 2008 Investments in Intangible Assets (% of firms with expenditures)

2008 Investments in Intangible Assets (Percent of Firms with Expenditures)			
	KFS		IIS
	All Firms	High-Tech Firms	All Firms
Any Intangible Asset Expenditures	48.9	64.5	68.1
Design of new and improved products and services	19.1	38.5	37.5
Investments in software or databases	24.8	46.3	65.3
Brand Development	33.9	40.3	55.8
Organizational Development	8.0	12.7	36.9
Worker Training	20.8	26.4	
Other Intangible Asset Investments	2.8	3.4	
N	2349	337	989

Source: KFS for US and IIS for UK

Table 2: 2008 Investment levels (for firms with Intangible Asset Expenditures)

2008 Investment Levels (For Firms with Intangible Asset Expenditures)			
	KFS		IIS
	All Firms	High-Tech Firms	All Firms
Investments in Intangible Assets	$27,759	$101,743	£357,557
Total Expenses	$688,198	$847,466	£14,100,000
Intangible Expenditure as a % of Total Expenses	4%	12%	3%
N	1311	234	547

Source: KFS for US and IIS for UK

Table 3: R&D and Intangible Assets Investments

R&D and Intangible Assets Investments				
	KFS		IIS	
	% of Firms	Average Amounts	% of Firms	Average Amounts
R&D Spending	14.2%		15.9%	
For Firms with R&D spending				
R&D Spending	100.0%	$55,295	100.0%	£276,626
Intangible Asset Spending	92.2%	$58,581	89.2%	£787,369
Intangible Assets Expenditures	48.9%		68.1%	
For firms with Intangible Assets Expenditures				
R&D Spending	24.8%	$60,214	20.8%	£59,255
Intangible Asset Spending	100.0%	$27,759	100.0%	£346,057
Firms that offer a Product				
R&D Spending	19.1%	$71,369	18.0%	£88,555
Intangible Asset Spending	59.1%	$34,221	61.6%	£435,953
Firms that offer a Service				
R&D Spending	13.6%	$43,072	15.2%	£29,213
Intangible Asset Spending	53.1%	$25,279	70.3%	£169,938

Source: KFS for US and IIS for UK

Table 4: Fractions of overall intangible spending accounted for by different assets: macro and micro data compared (UK data only)

Variable	All firms	Excluding highest 5%	Macro Data
Number of observations*	989	875	
Software	0.14	0.23	0.16
Marketing	0.17	0.19	0.23
R&D	0.16	0.14	0.13
Design	0.21	0.26	0.28
Process changes	0.32	0.19	0.20

Source: IIS data for UK. Second column excludes firms with highest 5% of intangible expenditure.

Table 5: Life length of intangible assets, UK data.

Asset	Number of firms	Average benefit time (months)
Training	200+	27
Software	200+	39
Reputation	10-200	29
R&D	10-200	52
Design	10-200	42
Business process	10-200	41

Source: ONS IAS. Number of firms is banded to prevent disclosure.

References

Brynjolfsson, Erik and Hitt, Lorin (2000) Beyond Computation: Information Technology, Organizational Transformation and Business Performance, Journal of Economic Perspectives, 14(4), 23-48.

Corrado, Carol, John Haltiwanger and Daniel Sichel (eds.) (2005), Measuring Capital in the New Economy, University of Chicago Press.

Corrado, Carol, Charles Hulten and Daniel Sichel (2006), "Intangible Capital and Economic Growth," NBER Working Paper No. 11948, January.

Corrado, C. A., Hulten, C. R. and Sichel, D. E. (2005). Measuring Capital and Technology: An Expanded Framework. In Measuring Capital in the New Economy, Vol. 65 (Eds, Corrado, C. A., Haltiwanger, J. C. and Sichel, D. E.). Chicago: The University of Chicago Press.

Corrado, C. A., Hulten, C. R. and Sichel, D. E. (2006). Intangible Capital and Economic Growth. NBER Working Papers 11948, National Bureau of Economic Research, Inc, forthcoming Review of Income and Wealth.

Davis, Steven, John Haltiwanger and Ron Jarmin (2008), "Turmoil and Growth: Young Businesses, Economic Churning and Productivity Gains," Kauffman Foundation.

Giorgio Marrano, M., Haskel, J. and Wallis, G. (2007). "What Happened to the Knowledge Economy? ICT, Intangible Investment and Britain's Productivity Record Revisited". Department of Economics, Queen Mary, University of London, forthcoming Review of Income and Wealth.

Haltiwanger, John, Lisa Lynch and Christopher Mackie (eds.) (2007), "Understanding Business Dynamics: An Integrated Data System for America's Future," National Research Council, National Academy of Sciences.

Lev, B, (2001), "Intangibles: Management Measurement and Reporting", Brookings Institution, Washington DC.

Nakamura, L. I. (2001). What is the US Gross Investment in Intangibles? (At Least) One Trillion Dollars a Year! (Ed, Department, R.). Philadelphia: Federal Reserve Bank of Philadelphia.

Appendix 1: Text of questions on intangible spending.

1. Kauffman survey

In the KFS, the new questions are below. For the full set of questions see www.kauffman.org/kfs.

F19b. Investments in intangible assets are expenditures expected to produce long-term benefits for businesses. I'm going to read you some types of intangible assets. When thinking about each category, please consider the cost of in-house activities in these areas including the time of the business owner(s), as well as services or license fees from outside providers.

Did [NAME BUSINESS] have expenditures in [ITEM] in calendar year 2008?

a. The design of new and improved products and services

b. Investments in software or databases?

c. Brand development such as advertising or marketing?

d. Organizational development such as company formation expenses or management consulting?

e. Worker training?

f. Any other intangible asset investments? (SPECIFY)

F19c. Thinking about all the intangible asset expenditures [LIST IF NECESSARY] you just told me about, please estimate [NAME BUSINESS]'s total expenses on intangible assets for calendar year 2008.

2. NESTA innovation survey

The table below sets out the questions regarding intangible assets expenditure. Each spending question is preceded by a filter question which we include since it explains the spending question. This gave 989 observations where there was non-missing spending data, that is to say, spending data that included zeros, but only zeros where firms had replied “no” to the initial did you spend filter question. We excluded firms who did not reply to the filter and omitted spending numbers.

Intangible Asset	Related Questions	Related Question Numbers
Software	Has your firm purchased new or improved software or computer networks over the last year?	D4a
Software	And roughly how much have you spent on software and computer networks over the last year?	D4b
Marketing	Has your firm invested in improving your reputation and branding over the last year, including spending on advertising, PR and market research?	F3a
Marketing	Roughly how much have you spent on improving your reputation and branding over the last year?	F3b
R&D	Has your firm conducted or commissioned any R&D (research and development) over the last year? By R&D I mean research to develop new products, services or processes or to improve existing ones?	D5a
R&D	Roughly how much have you spent on R&D over the last year? Please include expenditure on salaries, wages and staff time as well as equipment and any "bought in" R&D services.	D5b
Design	Has your firm invested in the design of new or improved products or services over the last year?	D7a
Design	Roughly how much have you spent on the design of new products or services over the last year? Please include expenditure on salaries, wages and staff time as well as equipment and any "bought in" services.	D7b
Process Change	Over the last three years have you made any significant changes to the business processes you operate in your firm?	C11
Process Change	Roughly how much have you spent on these process changes over the last year?	D15b

Appendix 2: Industry coverage of the NESTA Innovation Survey

Industry	NESTA Innov Survey Number of firms - Sam
Accountancy Services	134
Aerospace and Auto	41
Architectural Services	146
Construction	149
Consultancy Services	118
Energy Production	55
Legal Services	119
Software and IT Services	102
Specialist Design	125
Total	989