Intangible Investment at the Industry Level: Growth Accounting

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Intangible Investment at the Industry Level: Growth Accounting

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Abstract

This paper reports on the estimation of intangible assets by 1-digit NACE industries for 14 EU countries, as part of the work for the FP7 project INDICSER. It gives an overview of the methodology employed to construct investment series at current prices. We also describe the necessary adjustments to the input and output variables of the EU KLEMS database as well as the calculation of intangible capital services. Furthermore, we present descriptive statistics and growth accounting results for 9 EU countries. In general the contribution of intangible investment to growth in labor productivity is higher in manufacturing than in services. The highest contributions in the service sector are found in the UK.

Keywords: Intangible Capital, Growth Accounting.

JEL Classification Numbers: C82, E22, O47.

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1 Introduction

Recent research has highlighted the impact of intangible capital in explaining cross-country differences in productivity growth at the level of the aggregate economy. However to date systematic estimates at the industry level have not yet been constructed. Market economy estimates for European countries were based on two projects funded by the 7th EU Framework Programme, COINVEST and INNODRIVE, and recently combined into the INTAN-Invest database.[1] In the INDICSER database on intangibles, we use the INTAN-Invest database as a starting point for constructing estimates of 8 intangible assets at the level of NACE 1-digit industries. We obtain data for 14 countries for the years $1995-2007$. The assets we cover are the four categories of own-account intangible investment (organisational capital, firm-specific human capital, development of new financial products, R&D) and the four categories of purchased intangible investment (organisational capital[2], architectural and engineering designs, market research and advertising) covered by INTAN-Invest and not included in EU KLEMS. In this paper we describe the additional data and assumptions needed to construct intangible investment at current and constant prices at the sectoral level. We also compute the corresponding capital services and implement necessary adjustments to the input and output variables of the EU KLEMS database. We then conduct a growth accounting exercise for 9 countries and compare the contribution of intangible investment to labor productivity growth across sectors and countries.

2 Related Research

While the concept of intangible capital has been used in economic research for a long time, the explicit attempt to quantify it in a way that can be integrated into national accounts is still quite recent. Corrado et al. (2005) made the main contribution setting out the approach for categorizing and quantifying intangible capital at the level of the national economy. In particular they set out criteria for treating some expenditures as investment rather than as intermediate inputs. Corrado et al. (2009) construct intangible capital estimates for the U.S. and use them in a growth accounting framework. The inclusion of previously unmeasured inputs generally lowers the measured growth in multifactor productivity (MFP) and raises the measured contribution of capital inputs to growth in labor productivity. With their data, Corrado et al. (2009) find that the contribution of intangible capital to growth in labor productivity is about equal to the contribution of tangibles. After accounting for intangibles, capital instead of MFP constitutes the dominant source of growth. Internationally comparable data on intangibles have been constructed based on the approach by Corrado et al. (2005) in the projects INNODRIVE (Piekkola (2011)) and COINVEST and by The Conference Board.[3] Recently the three teams published harmonised data on intangibles at the country level on the platform INTAN-invest (Corrado et al. (2012)). COINVEST produced several studies on intangibles at the sectoral level with data for single countries or a small number of countries (see Haskel et al. (2010), Haskel and Pesole (2011) and Peters et al. (2010)). With UK data for the years $2000-2009$ Goodridge et al. (2012) find manufacturing to be the industry with the highest ratio of intangible investment to value added. Chun et al. (2012) compare Japanese to Korean data and find that the share of

[1] See: http://innodrive.org/ ; http://www.coinvest.org.uk/; http://www.intan-invest.net.
[2] INTAN-Invest only provides the sum of own account and purchased organisational capital.
[3] http://www.conference-board.org/data/intangibles/.

intangible investment in value added is higher in Japan in many industries. Meanwhile it turns out to be higher in Korea in some service industries. Estimating the influence of intangibles on conventional MFP for Japan, the authors find a significant positive effect for the market economy but no clear effect for the service sector. Other country-specific studies at the sectoral level are Baldwin et al. (2012), Barnes and McClure (2009) as well as Fukao et al. (2009). Sectoral estimates for intangibles for a larger number of countries are currently being produced starting from the INTAN-Invest database. As the aggregate data that developed from three different projects, a reference set of sectoral data will most likely emerge in the future from intertwined efforts by research teams at several institutions (including contributors to INTAN-Invest and OECD[4]). Currently comparable sectoral estimates for a large number of countries are still in a stage of experimentation. The approach we are proposing in the INDICSER project can at this stage by no means be considered as definitive but represents an early contribution towards establishing a methodology.

3 Data and Methodology

We calculate intangible investment at the sectoral level for 14 European countries (listed in table A.12) for the years $1995-2007$. Our main data source on intangible investment is the INTAN-Invest database described by Corrado et al. (2012), which contains data at the aggregate level for 7 different intangible assets not included in EU KLEMS. We apply additional sectoral information to the INTAN-Invest data to obtain estimates for the values of investment in individual assets and total intangible investment at the level of 1-digit industries of the NACE 1.1 classification. Table A.11 describes the industry coverage in detail. Sectoral shares of intangible assets are determined based on survey data on occupations, earnings and training, R&D data and supply and use tables. The data sources and procedures for each asset are described in section 4. For the construction of real intangible capital, investments are in general deflated with an index based on the deflator for value added from the EU KLEMS database (O'Mahony and Timmer (2009)), although the training capital uses an earnings deflator (see O'Mahony (2012)).

3.1 Calculation of Real Capital Stocks

The industry-specific intangible capital stock series A_t are constructed using the common Perpetual Inventory Method (PIM):

$$A_{k,j,t} = (1-\delta_k)A_{k,j,t-1} + I_{k,j,t}/Ip_t \tag{1}$$

where $I_{k,j,t}$ is the nominal investment in intangible capital. Nominal investment is deflated by Ip_t, which is the same for all industries j and intangible assets k (except training). It is based on the value added price index for the total business sector (BS).[5] δ_k is the time- and industry-invariant depreciation rate of asset k taken from Corrado et al. (2012). The initial capital stock in year 1995 is

[4] Squicciarini and Le Mouel (2012) compute organisational capital using U.S. data on the task content of work at the sectoral level.

[5] There are initial efforts to estimate specific investment price indices for intangibles (e.g. Corrado et al. (2011) and Copeland and Fixler (2012) for R&D).

derived from the following formula:

$$A_{k,j,1995} = Iq_{k,j,1995}/(\delta_k + \bar{g}) \tag{2}$$

with $Iq_{k,j,1995}$ being the real investment in 1995 in intangible asset k, $\bar{g}$ the average growth rate of real value added in total business sector between 1991 and 1999 (1995 – 1999 for the Czech Republic and Hungary) and δ_k again the depreciation rate of asset k.

3.2 Adjustments of Input and Output Variables

Because of the inclusion of intangible investment we have to adjust several EU KLEMS input and output variables. We adjust nominal value added as follows:

$$VA_{adj\,,j,t} = VA_{j,t} + \sum_{k \in INT} I_{k,j,t}\ . \tag{3}$$

An adjusted value added deflator $VA\_P_{adj,j,t}$ is calculated as:

$$\Delta \ln VA\_P_{adj,j,t} = \bar{v}_{VA,j,t} \Delta \ln VA\_P_{j,t} + \bar{v}_{INT,j,t} \Delta \ln Ip\_INT_t \tag{4}$$

where $\bar{v}_{VA,j,t}$ is the two-period average share of nominal value added VA in adjusted value added and $\bar{v}_{INT,j,t}$ the two-period average share of nominal intangible investment I_{INT} in adjusted value added. The purchased intangibles (OKp, Arch, MKTR and ADV) increase value added in industry j due to the reduced amount of intermediate inputs. Gross output stays the same. The own account intangibles (OKo, FSHK, NFP, and R&D) increase gross output and therefore value added of industry j (for an elaborate discussion see e.g. Statistisches Bundesamt (2009) page 60). We also have to re-calculate the internal rate of return. First we compute the industry-specific adjusted total capital compensation:

$$CAP_{adj\,j,t} = VA_{adj\,j,t} - LAB_{j,t} \tag{5}$$

where VA_{adj} denotes adjusted value added and LAB labor compensation. The nominal rate of return i for industry j is then defined as:

$$i_{j,t} = \frac{CAP_{adj\,j,t} + \sum_k (p^I_{k,j,t} - p^I_{k,j,t-1}) A_{j,k,t} - \sum_k p^I_{j,k,t} \delta_{j,k} A_{j,k,t}}{\sum_k p_{j,k,t-1} A_{j,k,t}} \tag{6}$$

where $p^I_{j,k,t}$, $\delta_{j,k}$ and $A_{j,k,t}$ are the investment price index, the depreciation rate and the real stock of all tangible and intangible assets k.[6] Table A.10 gives a list of the 16 assets covered. Based on this internal rate of return $i_{j,t}$, we calculate the asset-specific user costs of capital $q_{k,j,t}$ for all tangible and intangible assets:

$$q_{k,j,t} = p^I_{k,j,t-1} i_{j,t} + p^I_{k,j,t} \delta_{k,j} - \left[p^I_{k,j,t} - p^I_{k,j,t-1}\right]\ . \tag{7}$$

[6] Our numbers for the nominal rate of return including intangibles do not differ substantially from the original EU KLEMS values. Inklaar (2010) displays in table 1 similar effects for the US. We also re-calculate the standard EU KLEMS internal rate of return for industries D, G, I as their numbers are based on sub-industries. This allows a reasonable comparison of the growth accounting results with and without intangibles in tables 6.1-6.9.

The compensation of all assets is derived according to:

$$CAP_{adj\,k,j,t} = q_{k,j,t} A_{j,k,t} \ . \tag{8}$$

The industry-specific growth rate of new intangible capital services (INT) is calculated as follows:[7]

$$\Delta \ln K_{j,t}^{INT} = \ln K_{j,t}^{INT} - \ln K_{j,t-1}^{INT} = \sum_{k \in INT} \bar{w}_{k,j,t}^{INT} \Delta \ln A_{k,j,t} \tag{9}$$

with $\bar{w}_{k,j,t}^{INT}$ denoting the two-period average share of intangible asset k in total intangible capital compensation:

$$w_{k,j,t}^{INT} = \frac{q_{k,j,t} A_{k,j,t}}{\sum_{k \in INT} q_{k,j,t} A_{k,j,t}} \ . \tag{10}$$

The aggregation of input and output volumes to the total business sector (BS) is based on the Törnquist quantity index described in equation 17 of O'Mahony and Timmer (2009):

$$\Delta \ln K_{BS,t}^{INT} = \bar{\mu}_{j,t}^{INT} \sum_{j} \Delta \ln K_{j,t}^{INT} \tag{11}$$

with $\bar{\mu}_{j,t}^{INT}$ being the two-period average share of industry j in business sector intangible capital compensation.

4 Detailed Sources and Methods for Sectoral Estimates

4.1 Investment in Own Account Development of Organisational Structures (OKo)

The primary data sources for calculating own account organisational capital are occupation data from the harmonised EU Labour Force Surveys (EU LFS) and wage rates from the EU Structure of Earnings Survey (EU SES) and the Survey of Income and Living Conditions (EU SILC). For Germany, additional data on occupational shares from the Mikrozensus are used as the EU LFS series are only available from 2002. Annual estimates of own account intangible capital were calculated from 1995 to 2007. The process for calculating own account organisational capital for business sectors (A-K and O) was as follows:

1. Extract data from EU LFS on employees by 3-digit occupation group and skill level. The relevant occupation groups according to the ISCO88 classification are:

   - 121 Directors and Chief Executives
   - 122 Production and Operations Dept Managers
   - 123 Other Dept Managers
   - 131 General Managers.

   Note 123 includes R&D managers but there is insufficient information in the LFS to exclude these. The skill levels are High (ISCED 5,6), Intermediate (ISCED 3,4) and Low (ISCED 1,2).

[7] Similar calculations are used for ICT and Non-ICT capital.

2. Calculate expenditure on own account organisational investment by multiplying the employment shares of each occupation group by their earnings. For each industry and time period earnings by skill level were applied to each occupation group using data from EU KLEMS. An additional adjustment, common to all years, to take account of the generally higher wages of managers for all skill levels by industry was based on earnings data from EU SES and EU SILC. The small sample sizes in these surveys precluded estimating earnings of managers annually.

3. Calculate investment by multiplying the expenditures by a constant factor x (assumed to be 20% in INNODRIVE estimates).

4. Calculate the share of investment by industry in total business sector investment.

5. Apply these shares to own account organisational investments from INNODRIVE (The aggregate values of organisational investment correspond to those in INTAN-Invest. INNODRIVE contains additional information on the own account and the purchased component.).

Note, in practice step 3 is not necessary if the investment factor is assumed to be the same across industries.

4.2 Investment in Firm-Specific Human Capital (FSHK)

These estimates were derived from training propensities and duration of training from the EU LFS, with direct costs of training courses estimated from the Eurostat Continuous Vocational Training Surveys and opportunity costs based on average earnings by skill group from EU KLEMS. For details of the calculations see O'Mahony (2012).

4.3 New Product Development Costs in the Financial Industry (NFP)

New product development costs in the financial industry only occur in NACE rev.1.1 industry J and therefore equal business sector investment of INTAN-Invest. Value added in this sector is augmented by investment in new product development.

4.4 Scientific R&D (R&D)

The main source for our sectoral R&D estimates is the OECD ANBERD (Analytical Business Enterprise Research and Development) database (OECD (2011)). We use the variable R&D expenditures by main activity. For Denmark, France, Sweden and the United Kingdom we use the OECD BERD database (OECD (2012)).[8] We replace missing values by imputation and extrapolation techniques provided in the statistical software STATA. Imputation and extrapolation is based on nominal value added by industry taken from EU KLEMS. Neither of the OECD databases provides proper information for industries $K71t74$ and O, as observations are only available for total K and LtQ. As an ad-hoc solution we use the value for total K for $K71t74$ and a fixed percentage share of the value for industries LtQ for O.[9] To avoid double counting issues with software and NFP, we subtract industries

[8] Due to the lack of data, the industry shares in business sector R&D are the same for the whole period 1995-2007 in France and the UK.

[9] Based on the NACE rev. 2 numbers for $L68$ (real estate activities), the impact of including the corresponding NACE rev.1 $K70$ in our $K71t74$ estimates is negligible. Furthermore, we define the percentage share of O in LtQ as 0.2 for all countries.

$K72$ (computer and related activities) and J (financial intermediation) from our R&D estimates as in INTAN-Invest. As with organisational capital, we calculate industry shares and use INTAN-Invest totals as controls. Industry $K71t74$ includes $K73$ (research and development) which provides research activities for firms situated in other industries of the business sector. A considerable amount of R&D intangibles in $K73$ thus ought to be counted as purchased and not as own account intangible R&D capital. Therefore, not all R&D expenditures in $K73$ should, in principle, be treated as R&D intangibles for $K71t74$. At the current stage, we are unable to solve this problem.[10]

4.5 Investment in Purchased Organisational Structures (OKp), New Architectural and Engineering Designs (Arch), Market Research (MKTR) and Advertising Expenditure (ADV)

Our sectoral estimates for purchased intangible investments (OKp, Arch, MKTR and ADV) are based on use tables at purchasers' prices from the World Input-Output Database (WIOD) described by Timmer (2012). Investments for each of the four purchased intangible assets k in industry j at time t are calculated as follows:

$$I_{k,j,t} = I_{k,BS,t} * \text{use share of industry } j \text{ in CPA 2002 K74} \tag{12}$$

with $I_{k,BS,t}$ being the total business sector (BS) intangible investment taken from INTAN-Invest. We would prefer to have more detailed use tables incorporating data for $K74.13$ (MKTR), $K74.14$ (OKp), $K74.2$ (Arch) and $K74.4$ (ADV). They are currently only available for the UK and Spain in NACE rev. 1.1. Detailed data based on NACE 2 are only available for the year 2008. Figures A.1 and A.2 compare the WIOD-based shares with the more detailed ones of the national statistical offices of Spain and the United Kingdom. The amount of error by using the same WIOD-based $K74$ shares for OKp, Arch, MKTR and ADV is often rather small. The biggest difference occurs for Arch in industry F. The figures A.3 and A.4 show the evolution over time of the $K74$ shares in WIOD. Especially in the UK, we discover a clear upward trend of the use share of $K74$ in its own industry $K71t74$. We therefore prefer the WIOD-based approach over using the more detailed shares based on NACE rev. 2, which are available only for the year 2008.

Sectoral value added is increased by expenditures for these purchased services now counted as investment.

[10] As an ad-hoc solution, one could probably use the business sector industry shares in R&D expenditures to split up $K73$. Another potential source of error in our estimates of intangible R&D capital is the treatment of the public sector. Especially the higher education sector $M80.3$ is a potential supplier of additional intangible R&D investment in the business sector.

5 Descriptive Statistics

5.1 Industry Shares of Intangible Investment

We report descriptive statistics for the 9 countries for which we are able to compute growth accounting results: Austria, the Czech Republic, Denmark, Finland, Germany, Italy, the Netherlands, Spain and the UK. In most countries, the largest part of overall intangible investment is concentrated in the manufacturing sector (D). In Germany and Finland, the share exceeds 50 percent, while it is less in the other countries and only 22 percent in the UK. The business service sector ($K71t74$) and wholesale and retail trade (G) exhibit higher shares than the remaining sectors (see Table 5.1). Note that we use the term "intangible investment" for those intangible investments not included in the EU KLEMS data (a major category already included is software).

Table 5.1: Summary Statistics: Share of Industry j in Total Intangible Investment - Mean of Years 1995-2007

Industry	AUT	CZE	DNK	ESP	FIN	GER	ITA	NLD	UK
AtB	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
C	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
D	0.38	0.29	0.34	0.39	0.60	0.57	0.35	0.32	0.22
E	0.01	0.02	0.01	0.03	0.02	0.02	0.01	0.02	0.01
F	0.05	0.08	0.09	0.07	0.03	0.03	0.05	0.04	0.05
G	0.16	0.15	0.17	0.12	0.08	0.08	0.21	0.14	0.14
H	0.02	0.02	0.01	0.03	0.01	0.01	0.02	0.02	0.03
I	0.05	0.05	0.06	0.08	0.06	0.03	0.07	0.09	0.08
J	0.09	0.09	0.07	0.11	0.06	0.10	0.07	0.09	0.15
K71t74	0.20	0.24	0.19	0.12	0.10	0.14	0.18	0.22	0.25
O	0.04	0.04	0.04	0.04	0.03	0.02	0.04	0.04	0.06
BS	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.2: Summary Statistics: Share of Intangible Investment in Adjusted Value Added - Mean of Years 1995-2007

Industry	AUT	CZE	DNK	ESP	FIN	GER	ITA	NLD	UK
AtB	0.01	0.02	0.03	0.01	0.01	0.03	0.00	0.03	0.04
C	0.04	0.04	0.00	0.04	0.08	0.07	0.03	0.02	0.02
D	0.09	0.06	0.10	0.07	0.13	0.12	0.06	0.12	0.11
E	0.03	0.02	0.03	0.04	0.05	0.04	0.02	0.06	0.05
F	0.03	0.07	0.08	0.03	0.03	0.03	0.03	0.05	0.07
G	0.06	0.06	0.07	0.04	0.05	0.04	0.06	0.06	0.09
H	0.02	0.06	0.03	0.01	0.05	0.03	0.02	0.05	0.07
I	0.04	0.02	0.04	0.03	0.04	0.03	0.03	0.07	0.09
J	0.08	0.13	0.07	0.07	0.11	0.10	0.05	0.08	0.17
K71t74	0.11	0.15	0.12	0.06	0.09	0.06	0.06	0.10	0.15
O	0.05	0.07	0.05	0.04	0.04	0.03	0.05	0.06	0.10
BS	**0.07**	**0.06**	**0.07**	**0.04**	**0.08**	**0.07**	**0.05**	**0.08**	**0.10**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Looking at industry investment in intangibles relative to value added (Table 5.2), we observe that the share of manufacturing (D) and business services ($K71t74$) remains high. Meanwhile the high share of total intangibles attributed to the wholesale and retail trade industry (G) is close to average when

considered relative to value added. All countries except the Czech Republic and Germany display an above average share of intangible investment in manufacturing and in business services. In six countries, financial intermediation J also exhibits a share that exceeds the average.

5.2 Shares per Asset Type in Industry Intangible Investment

Tables 5.3 to 5.11 show total industry investment in intangibles split up into the shares of the 8 categories. The high share of intangibles relative to value added in manufacturing (D) seems to result from a large share of intangible investment in R&D in this sector. The share ranges from 28% in the UK to 55% in Austria and Germany.

The business services sector ($K71t74$) also displays a high share of intangible investment relative to value added, but here systematic reasons are less visible from the distribution of intangible investment over the different categories. In Austria and Denmark, the shares of investment in own account organisational capital and firm-specific human capital are relatively high. In Austria, Denmark, Finland and the UK, the share of R&D in intangible investment in business services is much higher than in other countries. Since the measurement of R&D investment in this sector remains problematic (see section 4.4), these numbers have to be interpreted with caution. In financial intermediation (J) there is not any R&D investment, but the share of investment in development of new financial products is high compared to the R&D shares in other sectors.

Table 5.3: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - AUT - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.39	0.11	0.08	0.02	0.16	0.00	0.17	0.07	1.00
C	0.10	0.14	0.03	0.03	0.18	0.00	0.19	0.33	1.00
D	0.14	0.06	0.06	0.01	0.09	0.00	0.09	0.55	1.00
E	0.25	0.10	0.28	0.02	0.14	0.00	0.14	0.08	1.00
F	0.16	0.15	0.17	0.03	0.22	0.00	0.23	0.03	1.00
G	0.44	0.10	0.08	0.02	0.14	0.00	0.15	0.06	1.00
H	0.42	0.12	0.07	0.02	0.17	0.00	0.18	0.00	1.00
I	0.23	0.12	0.21	0.02	0.17	0.00	0.18	0.07	1.00
J	0.29	0.10	0.20	0.02	0.14	0.12	0.14	0.00	1.00
K71t74	0.12	0.15	0.05	0.03	0.21	0.00	0.22	0.23	1.00
O	0.25	0.15	0.13	0.03	0.21	0.00	0.22	0.01	1.00
BS	**0.22**	**0.10**	**0.09**	**0.02**	**0.14**	**0.01**	**0.15**	**0.27**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.4: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - CZE - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.40	0.12	0.05	0.05	0.12	0.00	0.17	0.09	1.00
C	0.18	0.19	0.04	0.07	0.18	0.00	0.26	0.08	1.00
D	0.13	0.13	0.02	0.05	0.12	0.00	0.18	0.37	1.00
E	0.24	0.18	0.08	0.07	0.17	0.00	0.25	0.01	1.00
F	0.15	0.22	0.01	0.08	0.21	0.00	0.31	0.03	1.00
G	0.14	0.22	0.01	0.08	0.21	0.00	0.32	0.02	1.00
H	0.17	0.22	0.00	0.08	0.21	0.00	0.31	0.00	1.00
I	0.20	0.20	0.04	0.07	0.19	0.00	0.28	0.02	1.00
J	0.13	0.19	0.03	0.07	0.18	0.13	0.27	0.00	1.00
K71t74	0.04	0.22	0.02	0.08	0.21	0.00	0.31	0.12	1.00
O	0.11	0.23	0.02	0.08	0.22	0.00	0.33	0.02	1.00
BS	**0.12**	**0.19**	**0.02**	**0.07**	**0.18**	**0.01**	**0.27**	**0.14**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.5: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - DNK - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.04	0.18	0.11	0.06	0.26	0.00	0.32	0.03	1.00
C	0.11	0.13	0.27	0.05	0.19	0.00	0.24	0.01	1.00
D	0.08	0.05	0.16	0.02	0.08	0.00	0.09	0.52	1.00
E	0.08	0.08	0.44	0.03	0.12	0.00	0.15	0.09	1.00
F	0.03	0.19	0.11	0.07	0.27	0.00	0.33	0.00	1.00
G	0.22	0.11	0.15	0.04	0.15	0.00	0.19	0.15	1.00
H	0.18	0.14	0.16	0.05	0.20	0.00	0.25	0.02	1.00
I	0.13	0.10	0.28	0.04	0.15	0.00	0.19	0.12	1.00
J	0.20	0.07	0.31	0.02	0.10	0.19	0.12	0.00	1.00
K71t74	0.09	0.10	0.14	0.04	0.15	0.00	0.18	0.30	1.00
O	0.10	0.15	0.22	0.05	0.21	0.00	0.26	0.00	1.00
BS	**0.11**	**0.10**	**0.17**	**0.03**	**0.14**	**0.01**	**0.17**	**0.27**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.6: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - ESP - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.17	0.04	0.13	0.04	0.11	0.00	0.11	0.40	1.00
C	0.18	0.08	0.08	0.08	0.20	0.00	0.19	0.19	1.00
D	0.11	0.08	0.07	0.07	0.18	0.00	0.18	0.31	1.00
E	0.11	0.10	0.09	0.09	0.24	0.00	0.24	0.13	1.00
F	0.08	0.11	0.14	0.10	0.27	0.00	0.26	0.04	1.00
G	0.17	0.11	0.09	0.10	0.26	0.00	0.26	0.02	1.00
H	0.14	0.09	0.23	0.09	0.22	0.00	0.22	0.01	1.00
I	0.14	0.09	0.12	0.08	0.21	0.00	0.21	0.16	1.00
J	0.25	0.05	0.11	0.05	0.12	0.32	0.12	0.00	1.00
K71t74	0.13	0.09	0.13	0.09	0.23	0.00	0.23	0.09	1.00
O	0.13	0.10	0.16	0.10	0.25	0.00	0.24	0.02	1.00
BS	**0.14**	**0.08**	**0.10**	**0.08**	**0.20**	**0.04**	**0.20**	**0.16**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.7: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - FIN - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.23	0.10	0.32	0.03	0.14	0.00	0.15	0.04	1.00
C	0.18	0.13	0.09	0.03	0.18	0.00	0.20	0.18	1.00
D	0.08	0.08	0.07	0.02	0.11	0.00	0.12	0.52	1.00
E	0.13	0.12	0.22	0.03	0.17	0.00	0.18	0.14	1.00
F	0.12	0.14	0.19	0.04	0.19	0.00	0.21	0.12	1.00
G	0.29	0.10	0.21	0.03	0.14	0.00	0.15	0.08	1.00
H	0.26	0.14	0.17	0.04	0.19	0.00	0.20	0.00	1.00
I	0.19	0.11	0.17	0.03	0.15	0.00	0.17	0.19	1.00
J	0.48	0.02	0.20	0.01	0.03	0.23	0.03	0.00	1.00
K71t74	0.19	0.08	0.19	0.02	0.11	0.00	0.12	0.29	1.00
O	0.19	0.10	0.38	0.03	0.14	0.00	0.15	0.02	1.00
BS	**0.14**	**0.09**	**0.12**	**0.02**	**0.12**	**0.01**	**0.13**	**0.36**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.8: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - GER - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.10	0.22	0.06	0.06	0.20	0.00	0.25	0.10	1.00
C	0.12	0.21	0.07	0.06	0.20	0.00	0.24	0.12	1.00
D	0.07	0.10	0.04	0.03	0.10	0.00	0.12	0.55	1.00
E	0.10	0.19	0.19	0.06	0.19	0.00	0.22	0.06	1.00
F	0.12	0.21	0.13	0.06	0.20	0.00	0.25	0.02	1.00
G	0.34	0.16	0.11	0.05	0.15	0.00	0.18	0.01	1.00
H	0.40	0.15	0.10	0.04	0.14	0.00	0.17	0.00	1.00
I	0.16	0.16	0.18	0.05	0.15	0.00	0.18	0.12	1.00
J	0.08	0.20	0.10	0.06	0.19	0.15	0.23	0.00	1.00
K71t74	0.07	0.22	0.09	0.06	0.21	0.00	0.26	0.09	1.00
O	0.17	0.20	0.16	0.06	0.19	0.00	0.23	0.00	1.00
BS	**0.10**	**0.14**	**0.07**	**0.04**	**0.14**	**0.01**	**0.16**	**0.33**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.9: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - ITA - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.40	0.15	0.04	0.11	0.12	0.00	0.17	0.00	1.00
C	0.26	0.13	0.03	0.09	0.10	0.00	0.14	0.26	1.00
D	0.11	0.14	0.02	0.10	0.11	0.00	0.15	0.37	1.00
E	0.15	0.15	0.13	0.11	0.11	0.00	0.16	0.20	1.00
F	0.07	0.25	0.02	0.19	0.19	0.00	0.28	0.01	1.00
G	0.08	0.25	0.00	0.18	0.19	0.00	0.27	0.01	1.00
H	0.12	0.24	0.01	0.18	0.19	0.00	0.27	0.00	1.00
I	0.09	0.23	0.02	0.17	0.18	0.00	0.26	0.04	1.00
J	0.49	0.06	0.06	0.04	0.04	0.25	0.06	0.00	1.00
K71t74	0.05	0.23	0.02	0.17	0.18	0.00	0.25	0.12	1.00
O	0.16	0.23	0.02	0.17	0.18	0.00	0.25	0.00	1.00
BS	**0.12**	**0.19**	**0.02**	**0.14**	**0.15**	**0.02**	**0.21**	**0.16**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.10: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - NLD - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.16	0.22	0.05	0.10	0.13	0.00	0.17	0.16	1.00
C	0.09	0.14	0.07	0.07	0.09	0.00	0.11	0.43	1.00
D	0.11	0.14	0.05	0.07	0.08	0.00	0.11	0.44	1.00
E	0.17	0.25	0.08	0.12	0.14	0.00	0.19	0.05	1.00
F	0.28	0.19	0.13	0.09	0.12	0.00	0.15	0.04	1.00
G	0.23	0.22	0.08	0.11	0.13	0.00	0.17	0.06	1.00
H	0.31	0.22	0.07	0.10	0.13	0.00	0.17	0.00	1.00
I	0.12	0.26	0.10	0.12	0.16	0.00	0.20	0.04	1.00
J	0.16	0.15	0.17	0.07	0.09	0.24	0.12	0.00	1.00
K71t74	0.12	0.24	0.12	0.12	0.15	0.00	0.19	0.05	1.00
O	0.17	0.25	0.11	0.12	0.15	0.00	0.20	0.00	1.00
BS	**0.15**	**0.20**	**0.09**	**0.09**	**0.12**	**0.02**	**0.15**	**0.17**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 5.11: Summary Statistics: Share of Intangible Asset k in Total Intangible Investment - UK - Mean of Years 1995-2007

Industry	OKo	OKp	FSHK	MKTR	ADV	NFP	Arch	R&D	INT
AtB	0.31	0.19	0.09	0.07	0.15	0.00	0.18	0.02	1.00
C	0.21	0.15	0.24	0.05	0.11	0.00	0.14	0.09	1.00
D	0.28	0.08	0.20	0.03	0.06	0.00	0.07	0.28	1.00
E	0.25	0.11	0.40	0.04	0.08	0.00	0.10	0.02	1.00
F	0.30	0.14	0.25	0.05	0.11	0.00	0.14	0.01	1.00
G	0.36	0.14	0.19	0.05	0.10	0.00	0.13	0.04	1.00
H	0.36	0.14	0.21	0.05	0.11	0.00	0.13	0.00	1.00
I	0.23	0.12	0.25	0.04	0.09	0.00	0.11	0.16	1.00
J	0.29	0.14	0.16	0.05	0.11	0.11	0.13	0.00	1.00
K71t74	0.18	0.15	0.15	0.05	0.11	0.00	0.14	0.21	1.00
O	0.18	0.19	0.22	0.07	0.15	0.00	0.18	0.01	1.00
BS	**0.26**	**0.13**	**0.19**	**0.04**	**0.10**	**0.02**	**0.12**	**0.14**	**1.00**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

6 Growth Accounting Results

We are able to present growth accounting results for 9 out of the 14 EU countries for which we compiled sectoral intangible investment data (Tables 6.1 to 6.9). This restriction comes from the lack of publicly available tangible capital input data in EU KLEMS. Our results of growth accounting for the aggregate business sector are essentially those from the INTAN-Invest data. Slight differences result from using a bottom-up approach in aggregation.

The countries with the lowest average annual contribution of intangible capital to growth in labor productivity between 1995 and 2007 are Italy with a contribution of 0.1 percentage points and Denmark, Germany and Spain with a contribution of 0.2 percentage points. In Italy and Spain, growth in labor productivity is also low compared to other countries with annual averages below one percent. In Germany, average labor productivity growth is at a medium level with 1.8 percent. This growth is largely driven by the accumulation of non-ICT tangible capital and ICT.

Looking at sectoral results in Italy, only trade (G) displays a contribution of intangibles above 0.1 percentage points and contributions are even negative in some industries. Compared to other countries, the low contribution in the manufacturing sector (D: 0.1 percentage points) is particularly striking. In Germany and Spain, sectoral results are more varied, with manufacturing (D) and financial intermediation (J) reaching contributions of intangible capital of 0.3 to 0.5 percentage points. A main driver of the low average value in these countries is the business services sector ($K71t74$), where the accumulation of intangible capital is close to zero. Denmark's contribution of intangibles is highest in manufacturing (D: 0.5 percentage points) and finance (J: 0.4 percentage points), where the values are close to those observed in Germany. In business services ($K71t74$), the contribution of 0.2 percentage points is higher than in Italy, Germany and Spain.

At the level of the aggregate business sector, medium-range contributions of intangibles to labor productivity growth of 0.3 to 0.4 percentage points are observed in Austria, the Czech Republic and the Netherlands. Average growth in labor productivity amounts to 2.3 percent in the Netherlands, 2.4 percent in Austria and 4.0 percent in the Czech Republic.

In Austria, the contribution of intangibles is higher in manufacturing than in services. The residual MFP growth (after subtracting also the contribution of intangibles) displays the same pattern, whereas the ICT contribution is higher in services. In the Netherlands, the contribution of intangibles reaches 0.7 percentage points in manufacturing (D) and 0.8 in the energy sector (E). Values in the service sector lie between 0.2 and 0.4 percentage points. The value of 0.4 percentage points for the business services sector ($K71t74$) is large compared to the values observed in Denmark and Germany. In the Czech Republic, the contribution of intangibles is low in manufacturing and unusually high in construction. It is also quite high in hotels and restaurants (H), financial intermediation (J) and business services ($K71t74$) compared to other countries. There seems to be little relation between the contribution of intangibles and the growth rate of labor productivity in this country. Possible reasons are particular conditions in transition from a communist economy or measurement error.

The highest values of the aggregate contribution of intangibles to labor productivity growth are observed in the UK with 0.5 percentage points and in Finland with 0.6 percentage points. Within the Western European countries in our sample, these two countries also achieved the highest rates of labor productivity growth between 1995 and 2007. In the UK, the difference to the intangible contribution of other countries relies on the values attained in the service sector. The contribution is extremely high in financial intermediation (J) with 0.9 percentage points and the business services sector ($K71t74$) with 0.6 percentage points. But also wholesale and retail trade (G) and hotels and restaurants (H) achieve values that are larger in the UK than in other countries. In Finland, the contribution of intangibles to labor productivity growth stands out in the manufacturing sector (D) with a value of 1.1 percentage points. The values in wholesale and retail trade (G: 0.5 percentage points) and business services ($K71t74$: 0.3 percentage points) are also higher than in most other countries.[11]

[11] The contribution of intangibles in Finnish financial intermediation (J) of 2.1 percentage points looks questionable and may be related to some problem in the source data.

Table 6.1: Average Contribution to Labor Productivity Growth - 1995-2007 - AUT - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	3.8	0.1	0.2	0.0	0.3	3.2	3.8	0.1	0.2	0.3	3.2
C	5.4	0.2	0.4	0.2	0.1	4.4	5.5	0.2	0.5	0.1	4.7
D	5.0	0.3	0.2	0.7	0.2	3.4	4.9	0.4	0.3	0.3	3.9
E	5.1	0.2	0.1	0.2	0.1	4.4	5.1	0.2	0.1	0.1	4.6
F	2.7	0.1	0.1	0.3	0.1	2.0	2.5	0.1	0.1	0.1	2.2
G	1.4	0.5	-0.2	0.2	0.1	0.8	1.4	0.6	-0.2	0.1	0.9
H	0.5	0.2	-0.1	0.0	0.1	0.2	0.5	0.2	-0.1	0.1	0.2
I	2.5	0.4	0.4	0.3	0.1	1.3	2.3	0.4	0.5	0.1	1.4
J	1.3	0.8	0.2	0.2	0.3	-0.3	1.2	1.0	0.2	0.4	-0.3
K71t74	-0.9	0.9	-0.1	0.2	0.0	-1.9	-1.3	1.0	-0.2	0.0	-2.2
O	-1.1	0.3	-0.2	0.1	0.2	-1.5	-1.3	0.3	-0.2	0.2	-1.5
BS	**2.4**	**0.5**	**-0.0**	**0.4**	**0.2**	**1.4**	**2.2**	**0.5**	**-0.0**	**0.2**	**1.5**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.2: Average Contribution to Labor Productivity Growth - 1995-2007 - CZE - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	4.7	0.1	2.8	0.2	0.2	1.5	4.6	0.1	2.8	0.2	1.4
C	2.6	0.3	2.5	0.4	0.2	-0.9	2.3	0.4	2.6	0.2	-0.9
D	5.9	0.3	1.7	0.2	0.3	3.3	6.0	0.3	1.9	0.3	3.4
E	2.1	0.5	3.0	0.2	0.1	-1.7	1.9	0.6	3.0	0.1	-1.7
F	0.8	0.2	1.6	1.0	0.2	-2.2	-0.2	0.2	1.8	0.2	-2.4
G	7.6	0.8	1.4	0.2	0.3	4.8	7.9	0.8	1.5	0.3	5.0
H	-6.7	0.1	-0.1	0.6	0.8	-7.9	-7.7	0.1	-0.1	0.8	-8.4
I	3.3	1.3	2.3	0.3	0.1	-0.8	3.0	1.3	2.4	0.1	-0.8
J	5.5	1.3	0.3	0.7	0.4	2.8	5.5	1.5	0.3	0.4	3.2
K71t74	1.0	0.7	0.3	0.5	0.2	-0.7	0.5	0.8	0.3	0.2	-0.8
O	0.8	0.4	0.7	0.4	0.1	-0.9	0.4	0.4	0.8	0.2	-1.0
BS	**4.0**	**0.6**	**1.5**	**0.4**	**0.3**	**1.2**	**3.9**	**0.6**	**1.6**	**0.3**	**1.3**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.3: Average Contribution to Labor Productivity Growth - 1995-2007 - DNK - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	-0.3	0.3	0.6	0.1	-0.3	-1.0	-0.5	0.3	0.6	-0.4	-1.1
C	5.5	0.7	4.3	0.0	0.0	0.4	5.5	0.7	4.3	0.0	0.4
D	2.4	0.6	0.5	0.5	0.3	0.4	2.1	0.7	0.6	0.3	0.5
E	1.8	0.5	3.5	0.2	0.0	-2.3	1.6	0.4	3.6	0.0	-2.3
F	0.1	0.1	0.0	0.0	-0.1	0.0	0.1	0.1	0.0	-0.1	0.0
G	1.6	0.7	-0.1	0.2	-0.1	0.8	1.5	0.7	-0.1	-0.1	0.8
H	-3.3	0.3	0.0	-0.0	0.2	-3.8	-3.4	0.3	0.0	0.2	-4.0
I	2.8	0.9	0.7	0.1	-0.0	1.0	2.7	0.9	0.8	-0.0	1.0
J	5.0	2.4	-1.2	0.4	0.5	2.9	5.2	3.0	-1.7	0.5	3.4
K71t74	-0.8	1.3	0.1	0.2	0.1	-2.3	-1.3	1.4	0.0	0.1	-2.8
O	-1.0	1.1	0.4	0.2	0.0	-2.7	-1.3	1.2	0.5	0.0	-2.9
BS	**1.3**	**0.9**	**0.1**	**0.2**	**0.1**	**-0.1**	**1.1**	**1.0**	**0.1**	**0.2**	**-0.1**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.4: Average Contribution to Labor Productivity Growth - 1995-2007 - ESP - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	2.5	0.0	1.1	0.1	0.3	1.0	2.5	0.0	1.1	0.3	1.0
C	2.1	0.2	0.8	0.4	0.3	0.4	1.4	0.3	0.8	0.3	0.0
D	1.2	0.3	0.4	0.4	0.5	-0.4	0.9	0.3	0.4	0.6	-0.4
E	4.6	0.2	2.7	0.2	0.1	1.4	4.5	0.3	2.8	0.1	1.3
F	-1.8	0.1	-0.0	-0.1	0.3	-2.1	-1.8	0.1	-0.1	0.3	-2.2
G	1.2	0.3	0.8	0.3	0.5	-0.7	1.0	0.3	0.8	0.5	-0.7
H	-1.2	0.1	0.7	0.1	0.3	-2.4	-1.3	0.1	0.7	0.3	-2.4
I	1.5	1.0	1.2	0.2	0.4	-1.2	1.4	1.0	1.2	0.4	-1.2
J	5.2	0.9	-0.2	0.3	0.0	4.1	5.4	1.1	-0.3	0.1	4.5
K71t74	0.4	0.4	0.4	0.0	0.7	-1.2	0.3	0.5	0.5	0.7	-1.4
O	-0.0	0.6	1.5	0.1	0.4	-2.5	-0.1	0.6	1.6	0.4	-2.6
BS	**0.8**	**0.3**	**0.4**	**0.2**	**0.5**	**-0.6**	**0.7**	**0.4**	**0.5**	**0.5**	**-0.7**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.5: Average Contribution to Labor Productivity Growth - 1995-2007 - FIN - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	5.0	0.1	0.4	0.1	0.4	4.1	5.0	0.1	0.4	0.4	4.1
C	-0.8	0.1	0.9	-0.1	-0.0	-1.6	-0.8	0.1	0.9	-0.0	-1.8
D	6.1	0.3	0.1	1.1	0.2	4.3	6.2	0.4	0.2	0.2	5.3
E	5.0	0.4	1.8	0.1	-0.0	2.6	5.2	0.5	1.9	-0.0	2.8
F	0.7	0.1	0.0	0.3	-0.1	0.4	0.3	0.1	0.0	-0.1	0.3
G	3.3	0.5	-0.5	0.5	-0.1	3.0	3.0	0.5	-0.6	-0.1	3.2
H	-0.7	0.1	-0.0	0.1	0.2	-1.0	-0.8	0.1	-0.0	0.2	-1.1
I	3.9	0.6	0.1	0.2	-0.0	2.9	3.9	0.7	0.1	-0.0	3.1
J	2.2	2.2	-1.3	2.1	0.3	-1.1	1.4	3.5	-2.1	0.3	-0.2
K71t74	0.5	0.4	-0.0	0.3	-0.0	-0.2	-0.0	0.4	-0.1	-0.0	-0.3
O	-0.3	0.6	-0.5	0.3	0.2	-0.8	-0.6	0.6	-0.5	0.2	-0.9
BS	**3.6**	**0.4**	**-0.2**	**0.6**	**0.2**	**2.5**	**3.4**	**0.5**	**-0.3**	**0.3**	**2.9**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.6: Average Contribution to Labor Productivity Growth - 1995-2007 - GER - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	4.0	0.1	-0.4	0.2	-0.4	4.6	3.8	0.1	-0.4	-0.4	4.6
C	0.9	0.1	0.1	0.1	0.2	0.5	1.0	0.1	0.1	0.2	0.5
D	3.2	0.2	0.3	0.5	0.2	2.0	3.1	0.2	0.4	0.3	2.2
E	4.4	0.3	2.2	0.2	0.1	1.6	4.4	0.3	2.3	0.1	1.7
F	-0.1	0.1	0.0	0.1	0.2	-0.4	-0.1	0.1	0.0	0.2	-0.4
G	1.9	0.3	0.2	0.0	-0.1	1.4	2.0	0.4	0.2	-0.1	1.4
H	0.1	0.1	-0.0	-0.0	-0.0	0.1	0.1	0.0	-0.0	-0.0	0.1
I	4.0	0.4	0.9	0.1	-0.2	2.7	4.0	0.4	0.9	-0.2	2.8
J	1.5	0.6	0.2	0.5	0.1	0.2	1.3	0.7	0.2	0.1	0.3
K71t74	-1.5	1.1	0.4	0.1	-0.1	-3.0	-1.7	1.3	0.5	-0.1	-3.3
O	-0.7	0.2	-0.1	0.0	-0.2	-0.6	-0.7	0.2	-0.1	-0.2	-0.6
BS	**1.8**	**0.5**	**0.5**	**0.2**	**-0.0**	**0.6**	**1.7**	**0.5**	**0.5**	**-0.0**	**0.7**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.7: Average Contribution to Labor Productivity Growth - 1995-2007 - ITA - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	2.2	0.0	0.9	0.0	0.2	1.1	2.2	0.0	0.9	0.2	1.1
C	0.7	0.0	2.3	-0.1	0.1	-1.6	0.7	0.0	2.5	0.1	-1.8
D	0.7	0.2	0.5	0.1	0.2	-0.4	0.5	0.2	0.5	0.2	-0.4
E	2.3	0.1	2.1	0.1	-0.0	0.0	2.3	0.1	2.2	-0.0	0.0
F	-0.8	0.1	0.5	-0.0	0.1	-1.5	-0.8	0.1	0.6	0.1	-1.6
G	0.9	0.2	0.8	0.3	0.3	-0.7	0.7	0.2	0.9	0.4	-0.8
H	-0.6	0.1	0.4	0.1	0.2	-1.4	-0.7	0.1	0.4	0.2	-1.4
I	2.2	0.2	0.6	0.1	0.1	1.2	2.2	0.2	0.6	0.1	1.3
J	2.8	0.7	-0.2	0.1	0.1	1.9	2.8	0.8	-0.2	0.1	2.0
K71t74	-1.7	0.2	-1.1	-0.0	0.2	-0.9	-1.8	0.3	-1.2	0.2	-1.1
O	-1.1	0.4	0.6	0.1	0.0	-2.2	-1.3	0.4	0.7	0.0	-2.3
BS	**0.6**	**0.2**	**0.4**	**0.1**	**0.2**	**-0.4**	**0.5**	**0.2**	**0.4**	**0.2**	**-0.4**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.8: Average Contribution to Labor Productivity Growth - 1995-2007 - NLD - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	1.3	0.1	0.2	0.1	1.1	-0.2	1.2	0.1	0.2	1.1	-0.3
C	0.9	0.3	2.7	0.2	0.1	-2.4	0.8	0.4	2.9	0.1	-2.4
D	3.4	0.4	0.3	0.7	0.4	1.6	3.2	0.4	0.4	0.4	2.0
E	5.2	0.4	1.5	0.8	0.4	1.9	4.6	0.4	1.6	0.4	2.1
F	0.0	0.2	0.1	0.1	0.4	-0.9	-0.1	0.2	0.1	0.5	-0.9
G	3.8	0.4	0.1	0.3	0.0	2.9	3.8	0.5	0.1	0.0	3.1
H	0.6	0.1	0.1	0.2	0.0	0.2	0.5	0.1	0.1	0.0	0.2
I	4.8	0.6	0.5	0.4	0.2	3.0	4.7	0.6	0.5	0.3	3.3
J	3.1	1.4	-0.6	0.6	0.5	1.0	2.7	1.6	-0.7	0.6	1.3
K71t74	0.9	0.5	0.2	0.4	0.5	-0.8	0.5	0.6	0.3	0.5	-0.9
O	0.6	0.4	0.0	0.2	0.3	-0.3	0.5	0.4	0.0	0.3	-0.3
BS	**2.3**	**0.5**	**0.0**	**0.4**	**0.3**	**1.0**	**2.1**	**0.5**	**0.0**	**0.4**	**1.1**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table 6.9: Average Contribution to Labor Productivity Growth - 1995-2007 - UK - (With | Without Intangibles)

Industry	LP	ICT	NICT	INT	LAB	MFP	LP	ICT	NICT	LAB	MFP
AtB	3.2	0.0	0.7	0.1	0.5	1.9	3.2	0.0	0.7	0.5	2.0
C	-0.4	0.0	1.8	0.1	0.0	-2.2	-0.4	0.0	1.9	0.0	-2.3
D	3.5	0.4	0.3	0.6	0.6	1.5	3.5	0.5	0.4	0.7	1.8
E	2.6	0.7	1.0	0.1	0.0	0.7	2.7	0.7	1.1	0.0	0.8
F	1.5	0.1	0.4	0.5	0.2	0.3	1.3	0.1	0.6	0.2	0.3
G	3.2	0.6	0.7	0.6	0.3	0.9	3.0	0.7	0.8	0.4	1.1
H	1.4	0.3	0.7	0.4	0.5	-0.5	1.2	0.3	0.7	0.5	-0.4
I	4.6	1.5	0.2	0.2	0.2	2.5	4.8	1.5	0.2	0.2	2.9
J	4.3	1.1	-0.1	0.9	0.6	1.7	4.2	1.4	-0.2	0.7	2.3
K71t74	3.4	0.9	0.3	0.6	0.4	1.1	3.4	1.3	0.4	0.5	1.1
O	-0.3	0.3	0.5	0.2	0.4	-1.6	-0.5	0.3	0.5	0.4	-1.6
BS	**2.8**	**0.7**	**0.3**	**0.5**	**0.4**	**0.9**	**2.7**	**0.8**	**0.4**	**0.4**	**1.1**

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

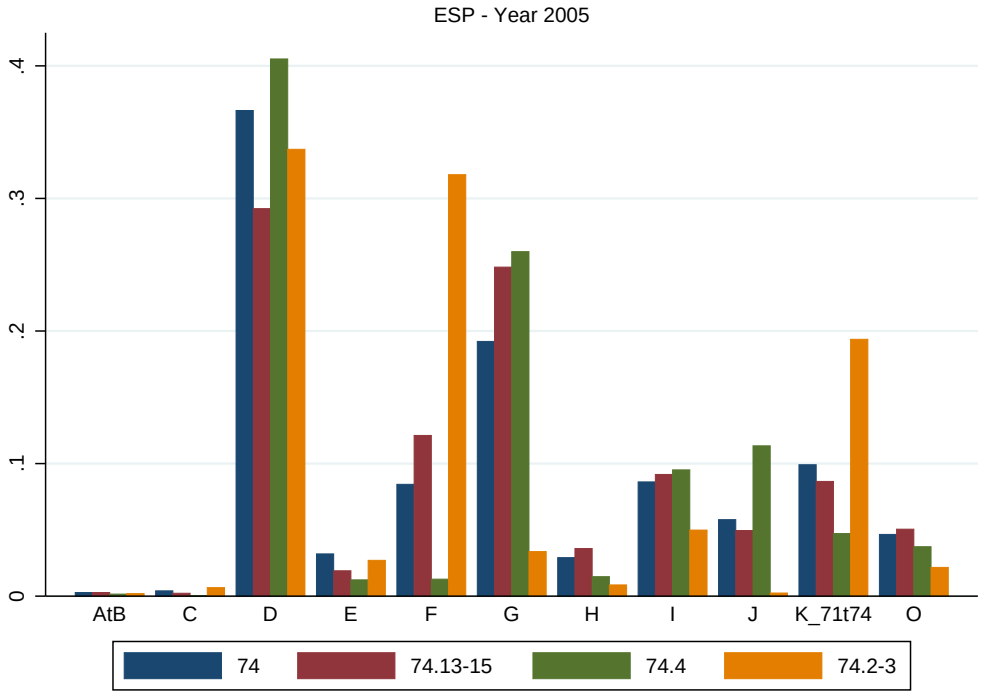
7 Conclusion

This paper is a first attempt to measure intangible investments and capital stocks by broad sector and country. It also uses the method of growth accounting to estimate contributions to labour productivity growth. Overall we find the contribution of intangibles to labor productivity growth to be higher in manufacturing than in services. This is in line with results found by Chun et al. (2012) for Japan. The high contribution of manufacturing is associated with a high share of intangible investment in value added in this sector. A large part of its intangible investment falls into the category R&D. In addition to the investment being higher, the low assumed depreciation rate of R&D capital may have an effect on the high contribution of intangibles to productivity growth in manufacturing. Meanwhile services are responsible for the high contribution of intangibles observed in the UK. The UK exhibits higher shares of intangible investment in value added in business services and financial intermediation than other countries.

A Appendix

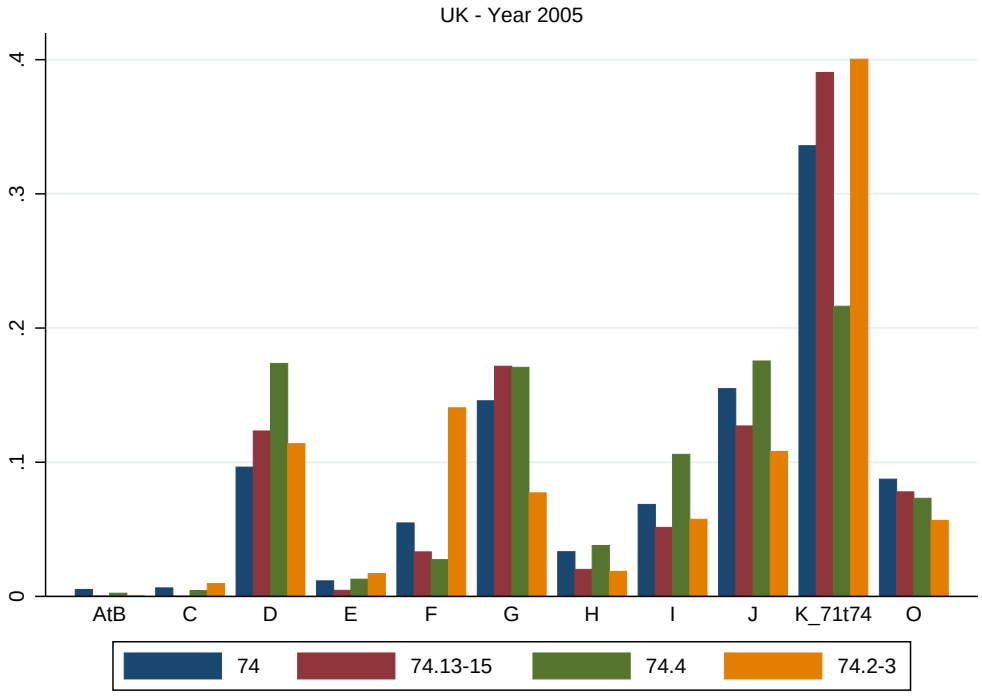
A.1 Additional Graphs

Figure A.1: Use Shares of Industries j of CPA 2002 74, 74.4, 74.2-3 and 74.13-15



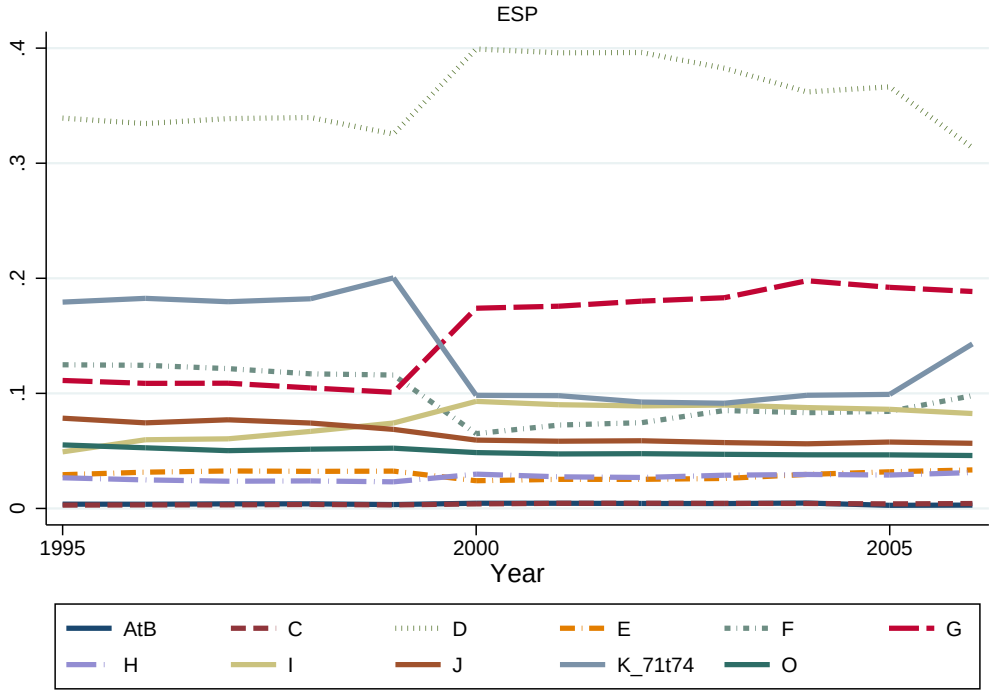
Source: WIOD and INE - own calculations.

Figure A.2: Use Shares of Industries j of CPA 2002 74, 74.4, 74.2-3 and 74.13-15



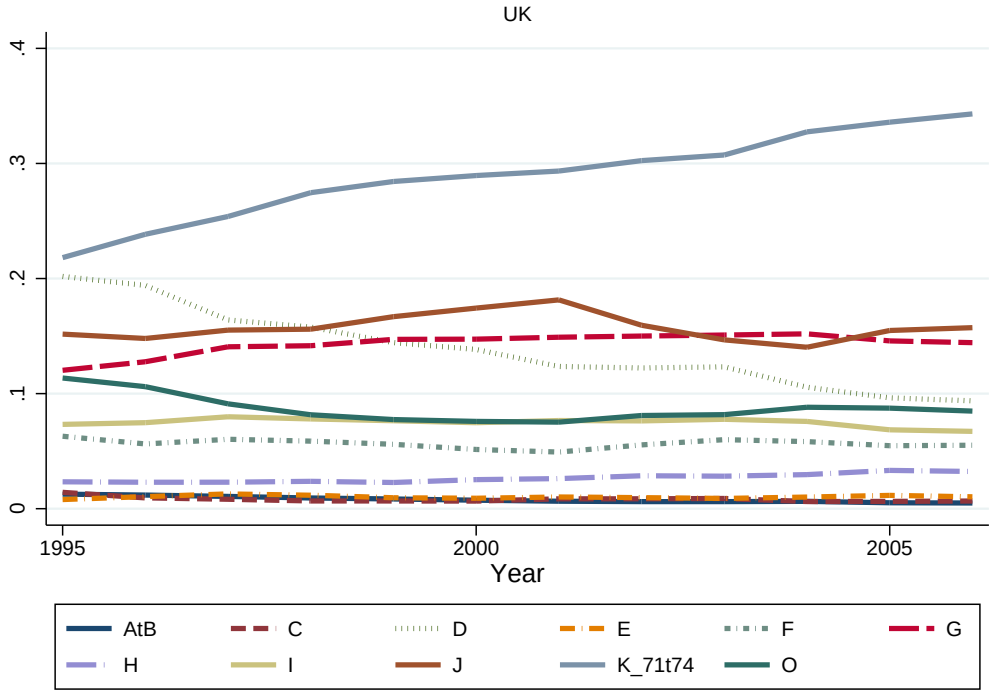
Source: WIOD and ONS - own calculations.

Figure A.3: Use Shares of Industries j of CPA 2002 74 - ESP



Source: WIOD - own calculations.

Figure A.4: Use Shares of Industries j of CPA 2002 74 - UK



Source: WIOD - own calculations.

A.2 Additional Descriptive Statistics

Table A.1: Summary Statistics: AUT - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	29,150	13,703	11,636	52,064
Non-ICT Capital Stock	274,366	8,484	261,345	286,047
Intangible Capital Stock	31,869	6,445	22,690	42,488
Nominal ICT Investment	4,061	779	2,754	4,855
Nominal Non-ICT Investment	22,281	2,789	17,766	26,073
Nominal Intangible Investment	10,294	2,417	6,706	14,497

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.2: Summary Statistics: CZE - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	347,792	149,721	116,916	539,276
Non-ICT Capital Stock	4,164,494	526,460	3,348,609	5,029,566
Intangible Capital Stock	273,900	49,982	215,733	370,275
Nominal ICT Investment	59,825	14,328	33,783	87,175
Nominal Non-ICT Investment	440,165	73,980	334,311	579,190
Nominal Intangible Investment	123,649	45,884	58,312	200,921

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.3: Summary Statistics: DNK - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	245,249	153,285	64,739	556,756
Non-ICT Capital Stock	1,353,230	93,116	1,199,083	1,490,958
Intangible Capital Stock	185,072	33,928	137,026	242,336
Nominal ICT Investment	37,206	9,411	24,411	55,737
Nominal Non-ICT Investment	126,338	16,477	99,657	162,524
Nominal Intangible Investment	62,517	15,411	40,904	92,150

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.4: Summary Statistics: ESP - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	74,536	29,750	35,085	129,259
Non-ICT Capital Stock	679,066	117,633	517,153	874,029
Intangible Capital Stock	51,289	12,355	35,915	75,946
Nominal ICT Investment	15,325	4,831	8,065	24,910
Nominal Non-ICT Investment	81,178	27,141	44,616	130,479
Nominal Intangible Investment	21,439	8,536	11,647	38,936

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.5: Summary Statistics: FIN - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	15,510	6,702	6,497	27,522
Non-ICT Capital Stock	140,679	5,101	131,777	148,303
Intangible Capital Stock	22,965	6,489	13,946	33,785
Nominal ICT Investment	2,978	638	1,968	4,088
Nominal Non-ICT Investment	10,759	1,464	7,992	13,973
Nominal Intangible Investment	7,361	2,163	4,083	11,123

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.6: Summary Statistics: GER - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	240,728	95,413	121,108	429,049
Non-ICT Capital Stock	2,121,131	103,691	1,938,097	2,267,585
Intangible Capital Stock	380,424	36,559	328,755	431,556
Nominal ICT Investment	37,372	4,984	29,946	46,024
Nominal Non-ICT Investment	179,674	12,882	167,294	211,838
Nominal Intangible Investment	103,351	13,736	81,152	122,341

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.7: Summary Statistics: ITA - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	131,847	44,299	69,144	203,269
Non-ICT Capital Stock	3,003,581	225,901	2,679,655	3,363,902
Intangible Capital Stock	108,905	11,841	90,666	128,251
Nominal ICT Investment	21,308	2,500	15,711	24,664
Nominal Non-ICT Investment	198,880	39,499	144,773	261,990
Nominal Intangible Investment	39,302	8,118	26,767	52,655

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.8: Summary Statistics: NLD - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	57,312	24,708	22,314	97,141
Non-ICT Capital Stock	394,638	18,573	357,582	409,496
Intangible Capital Stock	64,924	12,327	45,270	83,044
Nominal ICT Investment	10,013	2,050	5,930	13,115
Nominal Non-ICT Investment	32,695	3,682	27,309	38,369
Nominal Intangible Investment	24,251	6,399	14,369	34,782

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

Table A.9: Summary Statistics: UK - Business Sector (BS) - Mean of Years 1995-2007 - Millions of National Currency

Asset	Mean	SD	Min	Max
ICT Capital Stock	168,842	86,599	52,764	310,311
Non-ICT Capital Stock	736,350	65,525	628,029	827,624
Intangible Capital Stock	198,710	34,664	144,348	250,007
Nominal ICT Investment	29,384	5,080	19,112	35,699
Nominal Non-ICT Investment	73,651	7,599	58,577	88,383
Nominal Intangible Investment	78,480	19,648	48,224	107,994

Source: EU KLEMS Release 2009, INTAN-Invest and INDICSER - own calculations.

A.3 Classifications and Depreciation Rates

Table A.10: List of Assets

Acronym	Description	Depreciation Rate
INT	**New Intangibles**	
R&D	Scientific Research and Development	.150
FSHK	Firm-Specific Human Capital	.400
NFP	New Product Development Costs in the Financial Industry	.200
Arch	New Architectural and Engineering Designs	.200
MKTR	Market Research	.550
ADV	Advertising Expenditure	.550
OKo	Own Account Development of Organisational Structures	.400
OKp	Purchased Organisational Structures	.400
ICT	**ICT Assets**	
IT	Computing Equipment	
CT	Communications Equipment	
Soft	Software	
NonICT	**Non-ICT Assets**	
TraEq	Transport Equipment	
OMach	Other Machinery and Equipment	
OCon	Total Non-residential investment	
RStruc	Residential structures	
Other	Other assets	

Note: Depreciation rates for new intangible assets are taken from Corrado et al. (2012) page 25.
"New" intangibles are those not yet included in national accounts. ICT and Non-ICT assets are those covered by national accounts data in the EU KLEMS database.

Table A.11: Industry Coverage

NACE rev. 1.1	Description
AtB	Agriculture, Hunting, Forestry and Fishing
C	Mining and Quarrying
D	Total Manufacturing
E	Electricity, Gas and Water Supply
F	Construction
G	Wholesale and Retail Trade
H	Hotels and Restaurants
I	Transport and Storage and Communication
J	Financial Intermediation
K71t74	Renting of Machinery and Equipment and Other Business Activities
O	Other Community, Social and Personal Services
BS	**Business Sector (A-J, K71t74, O)**

Table A.12: Country Coverage

Country Code	Country
AUT	Austria
BEL	Belgium*
CZE	Czech Republic
DNK	Denmark
ESP	Spain
FIN	Finland
FRA	France*
GER	Germany
HUN	Hungary*
IRL	Ireland*
ITA	Italy
NLD	Netherlands
SWE	Sweden*
UK	United Kingdom

Note: * No descriptive statistics and growth accounting results.

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