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Intangible investments and innovation propensity: Evidence from the Innobarometer 2013

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ABSTRACT

This paper investigates the innovation impact of intangible investments. Drawing on the resource-based view of the firm, we argue that through intangible investments, companies acquire knowledge assets that increase their innovativeness. However, a greater innovation impact is expected from investing more in technological intangibles rather than in intangibles overall, and a greater one from using internal versus external resources. Through a new survey on a large sample of firms in 36 countries, accounting for different intangibles and addressing their endogeneity through proper instruments, these hypotheses are partially confirmed. Developing intangibles internally is actually the most innovation-impacting aspect, but not in manufacturing. Instead, by controlling for this choice and for that of investing in technological intangibles, the intensity of intangible resources is significant for innovation in manufacturing only. Policy/strategic implications about the need of readdressing the boost to intangible investments for the sake of innovation in Europe are drawn accordingly.

KEYWORDS

Innovation; intangibles; R&D

JEL CLASSIFICATION

O30; O32; O33

1. Introduction

Intangibles are nowadays considered a vital source of growth and competitiveness at the worldwide level. Following the seminal ‘growth-accounting’ work by Corrado, Haltiwanger and Sichel (2005) for the USA, evidence of that has been found with respect to different kinds of intangibles (i.e. ‘computerized information’, ‘innovative property’ and ‘economic competencies’) and across different European countries by Framework Research Projects like INNODRIVE, COINVEST, INDICSER and IAREG.¹ The debate about their role is still vivid nowadays. The recent initiative ‘Design for Innovation’, supported by the European Commission as a commitment (in the Innovation Union flagship initiative of the Europe

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¹In all of these studies, the reference is to the so-called CHS (Corrado-Hulten-Sichen) classification, which refers to three quite broad and internally heterogeneous categories. In brief, ‘computerized information’ refers to ‘knowledge embedded in major component, computer programs and computerized databases’, ‘innovative property’ to ‘knowledge acquired through scientific R&D and non-scientific inventive and creative activities’ and ‘economic competencies’ to ‘knowledge embedded in firm specific human and structural resources including brand names’ (Corrado, Haltiwanger, and Sichel 2005, 23).

2020 Growth Strategy) to ensure competitiveness, prosperity and well-being by bringing ideas and intangibles to the market, and the OECD (2013) Project 'New sources of growth: Knowledge-based capital', aimed at updating the range of policy frameworks to address the rise of intangible investments, are two important examples of the current policy focus on intangibles.

In all of these studies, one of the main mechanisms through which intangible investments are claimed to impact growth (of total factor productivity and labour productivity in particular) is through the introduction of new products/services, processes and organisational forms and practices that, being knowledge-intensive assets, intangibles are expected to favour. This has opened up a crucial link with innovation studies in the analysis of intangibles, which up to now has been however only been partially exploited. First of all, unlike in growth-accounting exercises at the macro-economic level (e.g. Marrano, Haskel, and Wallis 2009; Borgo et al. 2012), and in the studies on the productivity drivers at the micro-economic level (e.g. Bontempi and Mairesse 2008), micro-analyses of innovation generally focus on one, or at most few, intangible at the time. While they sometimes address the complementarity between 'some' intangibles, usually R&D and non-R&D ones (e.g. Hall, Lotti, and Mairesse 2013; Catozzella and Vivarelli 2014), they generally fall short to recognise the 'full' spectrum of intangible activities to which firms can resort for increasing their innovativeness. Second, very few of the several factors that productivity studies have found important for the decisional process to invest in intangibles (e.g. O'Mahony and Vecchi 2009), like the life expectancy of their benefits and their 'organizational mapping' in dedicated organisational departments/divisions, have been translated into innovation studies. In general, the firm's investment decision in intangible assets is treated as exogenous, without considering the strategic role that the firm attaches to these investments and to the patterns through which they are undertaken.

These are two unfortunate gaps in the analysis of intangibles due to a twofold motivation: (i) the theoretical framework in which the innovation analysis of intangibles has been so far relegated, represented by the R&D-based 'knowledge production function' (Griliches 1998) (KPF), simply augmented with the inclusion of some other intangibles (e.g. Conte and Vivarelli 2005); (ii) the supremacy of the Community Innovation Survey (CIS), where intangibles are simply treated as activities in which enterprises might have engaged for innovating, as a source of data to investigate their innovation impact (e.g. Ciriaci 2011a, 2011b; Garcia 2011).

Going beyond these two limitations represents the main value added of the paper. On the one hand, it integrates the KPF idea with some deeper theoretical propositions about intangibles and innovation coming from the resource-based view of the firm; on the other hand, it makes use of a novel flash survey carried out in Europe on intangibles, which enables us to focus on a wide array of them and on some important characteristics of these investments. By combining these two elements of originality, the paper aims at readdressing the relationship between intangibles and innovation in such a way to consider the intangibles complexity that productivity analyses have pointed out and in so doing to realign the two research streams more satisfactorily.

The rest of the paper is organised as follows. Section 2 illustrates the theoretical background and puts forward our research hypotheses. Section 3 describes the data-set and econometric strategy employed. Section 4 discusses the estimation results and draws some policy implications. Section 5 concludes.

2. Theoretical background

In innovation studies intangibles are usually treated as simple ‘inputs’ that, along with other tangible ones (e.g. labour, machinery and plants), enable firms to produce more (or more valuable) physical output as in the ‘standard’ production function framework (Montresor and Vezzani 2015), or new inventions as in the so-called ‘knowledge production function’ (Griliches 1998). In this line of investigation, the most relevant aspect is the knowledge intensity of intangibles, that is the knowledge their investments make available to firms for the learning processes on which their production and innovation activities draw, somehow in a black-boxed way. Accordingly, the focus here is nearly exclusively on how firms cumulate this knowledge over time and, net of its depreciation and obsolescence (metaphorically, forgetting and losing relevance), manage to build up an intangible capital input, which in the economics of innovation is usually treated as synonymous of ‘knowledge capital’ (e.g. Löf and Heshmati 2002) or ‘knowledge-based capital’ (OECD 2013). This ‘compact’ conceptual approach has crucial implications at the empirical level where the availability of data (e.g. long series of investments data, disaggregated depreciation rates, etc.) to build up this knowledge capital, typically through the so-called Perpetual Inventory Method (Goldsmith 1951), seriously undermines the chance of making reference to the wide spectrum of assets of which intangibles actually consist. As a result, the set of retained intangibles in the investigation of their innovation impact is generally not much more numerous than R&D and some few other non-R&D innovation inputs like ICT, training and design (e.g. Ciriaci 2011a, 2011b; Hall, Lotti, and Mairesse 2013), just to make few examples.

As we said, considering intangibles as simple innovative inputs and only seldom as an asset portfolio is not consistent with the growing empirical literature on intangibles, where a wide spectrum is considered together with a broader role, see Section 1. This is to us quite unfortunate, as a wider and broader innovation analysis of intangibles would be recommendable also by adopting a sounder theoretical perspective than the KPF one, such as the resource-based view of the firm: a research avenue that some few papers on intangibles have started undertaking recently (e.g. Molloy et al. 2011; Arrighetti, Landini, and Lasagni 2013).

In both its initial formulations (Wernerfelt 1984; Barney 1991) and its more recent refinements in terms of capabilities theories (Cohen and Levinthal 1990; Teece, Pisano, and Shuen 1997), the role of intangibles as an array of different assets driving a firm’s competitive advantage has actually emerged clearly.² In particular, extending the seminal idea by Penrose (1959), that resources should be appreciated for the ‘services’ they unfold and render to the firm, it can be observed that the multiplicity of intangibles enables the investing firm to embark in the different activities that constitute the innovation process at the firm level. Not only does investing in intangibles provide firms with more research and education-based knowledge to be used as direct ingredient for new inventions, such as for R&D (Mansfield 1984), software (Quintas 1994) and training (Lynch and Black 1998; Bontis and Fitz-enz 2002; Bresnahan, Brynjolfsson, and Hitt 2002) investments, but it also makes firms capable to render inventions more usable and appealing to the consumers—such as for design investments (Ravasi and Stigliani 2012; D’Ippolito 2014)—and their success

²In every standard textbook of strategic management drawing on such a resource-based view, intangibles are actually always presented following some kind of classification that points to their heterogeneity of characteristics and contribution to the firms’ competitive advantage. The most standard distinction isolates R&D, human capital and reputation and branding (see e.g. Grant 2013), but finer or different classifications can also be found, an issue to which we will return in the next Section.

more credible on the market—such as for reputation and branding (Aaker 2007; Wong and Merrilees 2008)—as well as to reorganise internally for translating new inventions into successful innovations—such as for organisation or business process improvements (Hsu and Fang 2009; Carmona-Lavado, Cuevas-Rodríguez, and Cabello-Medina 2010; Squicciarini and Le Mouel 2012).

In brief, adopting a resource-based view to intangibles, and meaning them as a portfolio of resources with different possible contributions to the innovation activities of the firm, we put forward our first research hypothesis:

Hp1: The choice of investing a larger amount of resources in intangibles (irrespectively from their kinds) increases the firm's propensity to innovate.

While looking at intangibles as a portfolio of knowledge activities, rather than a compact form of knowledge capital, the resource-based view of the firm carefully considers their inner characteristics and diversity. In pursuing a competitive advantage, different intangibles have different degrees of relevance, relative scarcity, transferability and imitability (Grant 2013). For the sake of innovation, instead, and more precisely for the sake of technological innovations (the focus of our application), different intangibles have different degrees of 'cognitive proximity' to the technological knowledge and the techno-economic functionality that characterise new products/services and production processes. R&D, for example, has always been considered the technological input by definition (Mairesse and Mohnen 2005; Cohen 2010), and a technological nature has also been recognised to software (Gago and Rubalcaba 2007; Higon 2012), whose consistent overlapping with R&D activities render their distinction extremely difficult in collecting the relevant data: a point that the Frascati Manual of the OECD, for example, recognises clearly. A technological nature can also be recognised to design, considering an engineering perspective, rather than an aesthetic one, according to which it would determine such inner technological characteristics like modularity, decomposability, complexity and the like (Candi 2006; Verganti 2008). Exploiting this technological proximity, investing more in intangibles of this kind can be expected to have a more direct and crucial impact on the firm's capacity to innovate than investing more in all types of intangibles. Indeed, in this latter case, resources could be distracted to other intangibles—like, for example, reputation and branding, organisation or business process improvements, and less distinctively, training—that, while also relevant (see Hp1), are possibly more functional to non-technological kind of innovations—like organisational and marketing innovations (Evangelista and Vezzani 2010).

Following this argument, we put forward our second research hypothesis:

Hp2: The choice of investing more in technological (vs. non technological) intangibles increases the firm's propensity to innovate to a greater extent than that of investing a larger (vs. smaller) amount of resources in intangibles overall.

A last but not least point that emerges from a resource-based view analysis of the firm's intangibles concerns the strategic choice of pursuing the relative investments internally rather than using external resources and competencies. Given that 'intangibles contribute to define the firm as a specific economic environment (i.e. a firm-specific environment) that is different and not replicable by the market' (Biondi and Reberieux 2012, 283), the distinction between externally acquired and internally developed intangibles becomes a crucial one, well beyond pure accounting implications. Indeed, this is also and above all a strategic distinction between a firm's choice of 'making' rather than 'buying' its intangibles, with all

the implications that the debate on vertical integration and outsourcing has stimulated, in transaction costs economics well before than in the resource/capabilities theories at stake here (e.g. Williamson 1981; Mahnke 2001). In particular, we have to retain that, as previous studies have shown, outsourcing or even offshoring the development of intangible assets could pose to the firm problems of knowledge fragmentation and questions of coordination and control, which could negatively impact on the innovation and, if not even, economic performances of the firm (Ceci and Masciarelli 2010; Grimaldi et al. 2010). Accordingly, we expect that the decision of investing in intangibles internally could be even more strategic and have a greater impact than that of dedicating these investments to technological intangibles in general and, for transitivity reasons across our hypotheses, of investing more resources in intangibles overall:

Hp3: The choice of investing more in internal (vs. external) intangibles increases the firm's propensity to innovate to a greater extent than the choice of investing more in technological (vs. non technological) intangibles, and than the choice of investing a larger (vs. smaller) amount of resources in intangibles overall.

In a concise and somehow alternative reading, these hypotheses focus on the three choices characterising the firm's strategic decision to invest in intangibles: (i) the choice about the amount of resources that are invested—Hp1; (ii) the relative importance of the choice of investing more in technological, rather than to non-technological intangibles, in comparison with the previous one—Hp2; and (iii) the relative importance of the choice of developing intangibles internally, rather than externally, in comparison with the previous two—Hp3. As we will say in the following, their testing requires the availability of different datasets than those normally used in innovation studies (e.g. the CIS), of which the Innobarometer 2013 represents an interesting example.

3. Empirical application

3.1. Data-set: the Innobarometer 2013

The empirical application of the paper uses a brand new survey named Flash Eurobarometer, 'Investing in Intangibles: Economic Assets and Innovation Drivers for Growth' (No 369): in brief, the Innobarometer-2013 (Montresor, Perani, and Vezzani 2014).

Drawing on previous surveys on intangibles in individual countries, mainly the one commissioned to NESTA by the UK Office for National Statistics (ONS) within the new 'Innovation Index' project, the Innobarometer 2013 was designed to perform a systematic investigation of firms' investment decisions in the six intangibles identified by the NESTA classification itself (see Awano et al. 2010), that is: (i) training, (ii) software development, excluding research and development and web design, (iii) research and development (R&D); (iv) design of products and services (excluding research and development); (v) company reputation and branding; and (vi) organisation or business process improvements.

The Innobarometer 2013 represents a unique multi-country micro-survey, with some relevant original features (http://ec.europa.eu/public_opinion/flash/fl_369_en.pdf). On the other hand, it is a flash survey, carried out with the CATI methodology,³ whose results should

³The computer-assisted telephone interviewing (CATI) is one of the most popular survey techniques, carried out through a telephone call with the interviewer generally following a script provided by a software program.

be interpreted with care, although systematic response biases and potential groups of outliers are not prohibitive problems (Montresor, Perani, and Vezzani 2014). The Innobarometer 2013 survey was submitted to a (realised) sample of 11,317 enterprises with at least 1 employee in the EU28 and in other 8 non-EU countries. Questions mainly referred to the year 2011 and were addressed to firms operating in Manufacturing (NACE Category C), Services (NACE Categories G/H/I/J/K/L/M/N/R) and Utilities (NACE Categories D/E/F). Both of these characteristics of the survey should be carefully considered in the empirical application. As far as the temporal context of the questionnaire is concerned, in the year of the survey (2011), many of the countries in the data-set were still involved in a deep economic crisis, which has been shown to affect their innovative behaviours in some recent studies (Archibugi, Filippetti, and Frenz 2013; Makkonen et al. 2014) and which could confound our focal relationship. Given that the questionnaire did not ask to the respondent firms information about the effect of the crisis and given its cross-sectional analysis, unfortunately, we can do nothing but retaining this aspect in the interpretation of our results, hoping that the controls we use for the sake of the firms' heterogeneity and a country indicator of the access to credit could account for it. In the same respect, the crisis could make (more) endogenous some of the intangible regressors we are interested in. This is particularly true for the choice of making or buying (intangibles), which some studies have shown to be used as a resilience device by firms (especially in some sectors, like automobiles) during the crisis (e.g. Ciravegna and Maielli 2011; Drauz 2014). The attempt we made to render this and the other regressors of our analysis exogenous by resorting to proper instruments is thus important also for this reason.

As far as the sectoral context of the survey is concerned, given the different patterns that innovation follows in manufacturing versus services, and the different kind of knowledge assets their respective business is intense of (Gallouj and Savona 2009; Ciriaci, Montresor, and Palma 2015), the econometric test of our hypotheses would presumably yield different results in the two realms. This is also an insight that comes from the studies that distinguish manufacturing from services in investigating the productivity impact of intangibles (e.g. Marrocu, Paci, and Pontis 2012). Accordingly, not only is fundamental to consider industry fixed effects in the aggregate estimates, but a disaggregate estimate of our focal relationship appears opportune too.

3.2. *Dependent variable and econometric model*

The econometric strategy that we follow to test our three research hypotheses uses as a dependent variable the firms' propensity to introduce either a product or a process innovation.⁴ More precisely, *Innovation* is a binary variable, which takes value 1 if the firm has introduced new or significantly improved products, services or processes and 0 otherwise.

The relationship between innovation and intangible investments could be in principle investigated by means of the following probit model:

$$P(Y = 1 | X, Z) = \Phi(X'\beta + Z'\gamma) \quad (1)$$

⁴Unfortunately, the questionnaire of the Innobarometer 2013 does not distinguish between product and process innovations nor does it contain questions on the firm's patenting activity.

where Φ is the standard cumulative normal function, Y represents the *Innovation* variable, X is the vector of the intangible investment we are interested in, and Z indicates a series of control variables.

However, given the cross-section nature of our data (see Section 3.1), as usual, the results of the estimates of Model (1) with a standard probit model would have to be interpreted at most as correlations. Moreover, it should also be considered that some unobserved covariates may be simultaneously correlated with *Innovation* and with our intangible regressors, thus biasing the coefficients. For these reasons, in the following, we instrument our focal regressors X with a set of exogenous variables (see Section 3.4). Given the binary nature of the dependent, we implement an instrumental variables probit estimation using the two-step estimator proposed by Newey (1987).

3.3. Independent and control variables

Following our theoretical premises (Section 2), our main independent variables represent the three aspects characterising the firm's decision to invest in intangibles from a strategic point of view: (i) the general resource intensity of these investments (*RESINT*); (ii) the intensity of resources dedicated to technological, rather than to non-technological investments (*TECINT*); and (iii) the intensity of internal versus external resources invested in intangibles (*INTDEV*).

These three variables are built up by looking at the answers the surveyed firms have provided with respect to the six intangibles of the survey, in particular with respect to the amount of resources they have declared to have invested in each of the six intangibles as a percentage of their total turnover, either internally or externally. More precisely, *RESINT* is defined as the average of the amount of resources that firms have invested in each of the intangibles considered as a percentage of their total turnover, irrespectively from their internal or external development: $RESINT = \frac{1}{12} \sum_{i=1}^{12} intangible_i$. Quite straightforward is also the construction of *INTDEV*, defined as the difference between the average of the resources invested internally and the average of those invested externally in the six intangibles of the survey: $INTDEV = \frac{1}{6} \sum_{i=1}^6 int_intangible_i - \frac{1}{6} \sum_{i=1}^6 ext_intangible_i$.

Some care is instead required by the construction of *TECINT*, which needs to be based on a consistent distinction between the kinds of intangibles at stake. Looking at the way in which they have been conceptualised and measured in the literature (for which see Section 2), we consider as technological those intangibles whose investments can be more easily related to a consequent increase of the technological knowledge of the firm, that is R&D, software and design. On the other hand, we deem non-technological the intangibles that 'crystallize' knowledge of more organisational nature and scope, that is: training, reputation and branding and organisation and business processes. On the basis of this distinction, we define *TECINT* as the difference between the average of the resources invested (internally or externally) in the three technological intangibles (R&D, software and design) and the average of those invested in the three non-technological ones (training, reputation and branding and organisation and business processes): $TECINT = \frac{1}{6} \sum_{i=1}^6 tec_intangible_i - \frac{1}{6} \sum_{i=1}^6 nontec_intangible_i$.

As we said, these three variables could suffer from problems of endogeneity, on which we will return in the next section. Before moving to this issue, we conclude the description of the regressors with the controls used to address the firms' unobserved heterogeneity. In this

Table 1. Sample descriptives.

	Percentiles					Obs.	Mean	SD
	10%	25%	50%	75%	90%			
<i>Intangible investments</i>								
Resource intensity	0.083	0.333	0.833	1.333	2.000	11,119	0.954	0.797
Internal development	-0.167	0	0.417	1.000	1.500	10,938	0.572	0.805
Technological intangibles	-1.167	-0.667	-0.167	0	0.500	11,045	-0.304	0.717
<i>Expected benefits</i>								
Technological	0	0	0.667	1.333	2	10,875	0.89	0.88
Non-technological	0	0.667	1	2	2.333	10,903	1.25	0.92
<i>Business priority</i>								
Price (Yes/No)						10,962	24.20%	
Differentiation (Yes/No)						10,962	37.90%	
<i>Controls</i>								
Young (Yes/No)						11,310	13.20%	
Group (Yes/No)						11,298	23.90%	
International (Yes/No)						11,317	16.80%	
<i>Size</i>								
_1_9						4,959	43.80%	
_10_49						3,469	30.70%	
_50_249						2,086	18.40%	
_250+						803	7.10%	
Access to credit	50.0	62.5	75.0	81.3	93.8	11,317	72.1	16.5

last respect, the Innobarometer 2013 provides us with the opportunity to consider at least the most relevant sources of this heterogeneity, such as those represented by: the firm's size, in terms of employees classes (*Employees*); its age, captured by its being founded after the year 2007 (*Young*); its belonging to a business group (*Group*); and its degree of internationalisation, captured by the firm's declaring that it sold the largest percentage of its turnover abroad (*International*). A proper set of country and industry fixed effects is also inserted.

In the absence of questionnaire-based information on the financial health of the firms, we have tried to capture this important driver of the innovation strategy, as well as of other related business strategies (that we are going to present in the following), by referring to the World Bank (Doing Business data) measure of the easiness of getting credit in the country where firms are based.⁵ Beside the inclusion of sector fixed effects in the estimation, possible differences in the impact of intangibles on innovativeness among Manufacturing and Services firms will be investigated by performing separate estimations for the two groups of industries.

Summing up, Table 1 reports the descriptive statistics of the variables defined above and Table 2 the correlation matrix for the main ones considered in the analysis.

Bivariate correlations are in general quite low and there is no indication of significant multicollinearity among the independent variables. The high values of the correlations between *RESINT* and technological and non-technological benefit should be eventually read as good sign, as both variables are used to instrument this dimension of intangible investments.

Also, the correlation between the two expected benefits is somehow expected and mainly driven by those firms investing (or not) in a wide range of intangibles. In particular, the former group of firms is likely to attach long-term expected benefit deriving

⁵The easiness of credit is measured with the strength of credit-reporting systems and the effectiveness of collateral and bankruptcy laws in facilitating lending. More precisely, this variable indicates how much a country is near to the best practice country and is built on the Strength of legal rights index, the Depth of credit information index, the Credit registry coverage and the Credit bureau coverage. We thank one of the reviewers for the suggestion to focus on this aspect.

Table 2. Correlations.

	1	2	3	4	5	6	7	8
1—Resource intensity	1.000							
2—Internal development	0.220	1.000						
3—Technological intangibles	-0.066	0.057	1.000					
4—Technological (benefit)	0.617	0.228	0.276	1.000				
5—Non-technological (benefit)	0.546	0.209	-0.255	0.591	1.000			
6—Price strategy (Yes/No)	-0.072	-0.054	-0.032	-0.081	-0.054	1.000		
7—Differentiation strategy (Yes/No)	0.075	0.059	-0.007	0.062	0.093	-0.151	1.000	
8—Access to credit	0.002	0.023	-0.058	-0.001	0.057	0.032	0.053	1.000

from the combination of different intangibles and therefore likely to declare higher values for each single item. In any case, in order to test the absence of multicollinearity issues, we have computed the average variance inflation factor for all the estimations presented throughout the paper: the highest value is 2.81, far below the thresholds normally accepted (5 or 10).

3.4. Instrumenting variables

As we said, our standard probit estimates may be affected by serious distortions, mainly due to the cross-sectional nature of the data. In particular, endogeneity could be an issue. For example, a lower intensity of resources invested in intangibles might be due to the shortage of cash flows and/or profits to reinvest by the less innovative firms.

This possible simultaneous correlation between unobserved covariates, on the one hand, and innovation and intangible variables, on the other hand, could end up with biasing the coefficients. Accordingly, in order to attenuate this problem, we search for a proper set of instruments for our main intangible regressors. A first couple of instruments were identified with the two standard Porterian alternatives of a Differentiation and a Price strategy for the

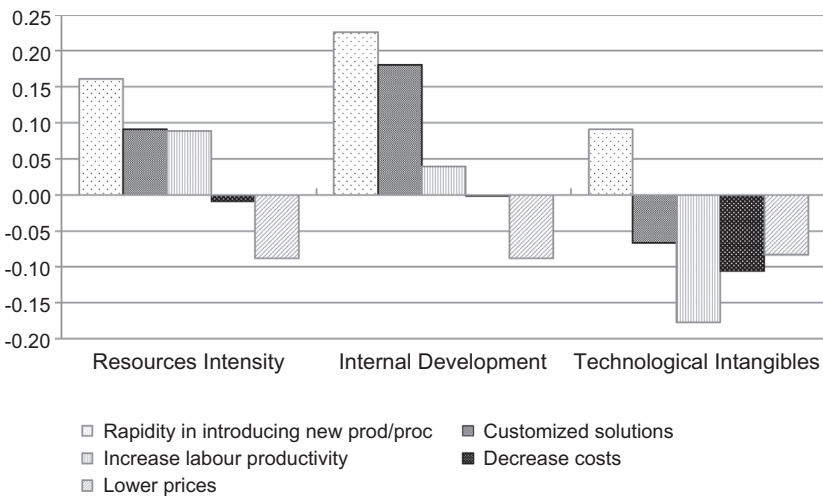


Figure 1. Firm priorities and intangible investment dimensions (differences from averages).

business priority of the firms, which we turned into two binary variables by looking at the relative responses to question Q1 of the questionnaire.⁶

Following a strategic management perspective, we deem these objectives do not affect the firm's innovation directly, while they should expect to have a positive and a negative impact, respectively, on the three strategic aspects of intangible investments we refer to. In particular, we claim that intangible resources are the key drivers of competitive advantage, when firms consider a 'differentiation strategy' as their main source of competitive advantage. Following a Porterian perspective, this strategy is generally targeted towards the search for a price premium for the firm's products, to whose acquisition the three intangible variables are directly related (Grant 2013). Conversely, the three intangible variables are relatively less pivotal in the case of a 'price strategy', in which cost advantages are instead typically driven by tangible investments (e.g. in physical capital leading to economies of scale) (Hall 1993; Galbreath 2005). Finally, it should be noted that the two options (differentiation and price strategy) that we have selected are presented in the questionnaire as alternative to others, which explicitly foresee an innovation strategy, that is: the rapid development of new product and services, the reduction of production costs and the increase in labour productivity (see Figure 1).⁷

Therefore, we are confident that the respondents were able to single out the two strategies we are referring to as not directly connected with innovation-specific objectives.

Additional two instruments have been identified by considering the firm's treatment of technological and non-technological intangibles as actual long-term 'assets'. More precisely, the two instruments *Technological Expected Benefits* and *Non-Technological Expected Benefits* are obtained by calculating the average, for each of the two groups of intangibles (see Section 3.2), of the number of years over which the surveyed firms have declared to expect economic benefits in question Q4 of the questionnaire.⁸ By definition, each of these variables is expected to have a positive (negative) impact on the firms' decision to invest in the (non) correspondent kind of intangibles, as well as positive effect on the other two intangible variables. Given their inclusion in the questionnaire before the innovation-related section, we think that the expectations to which the respondents refer to are not correlated with their innovation.

Concluding, it should be stressed that, as is always the case, the choice of proper instruments is always a difficult task, with respect to which only the relative test can give additional support to the above theoretical arguments.

4. Results

Before presenting the results of the IV-probit estimates in Tables 3 and 4, let us notice that a standard Wald test for the exogeneity of our instrumented intangible regressors rejects

⁶More precisely, in question Q1, firms were asked: 'Thinking about the priorities for your company, please tell me which two of the following are the most important?' The possible answers were: Rapid development of new products or services, Tailored, customised solutions, Ensuring lower prices, Increasing labour productivity, Decreasing the production costs and Other.

⁷Figure 1 shows for each intangible dimension the differences between the average of each firm priority group and the overall average.

⁸More precisely, in question Q4, firms were asked: 'On average, for how long does your company expect to benefit from its investments in the following activities?' The activities referred to are the six intangibles discussed in throughout the paper.

Table 3. First step: Instrumenting intangible investments.

	(I) All sample			(II) Manufacturing			(III) Services		
	RESINT	INTDEV	TECINT	RESINT	INTDEV	TECINT	RESINT	INTDEV	TECINT
<i>Business priority</i>									
Price	-0.025* [0.014]	-0.051*** [0.019]	0.010 [0.014]	-0.005 [0.033]	-0.078* [0.043]	-0.66** [0.029]	-0.046** [0.018]	-0.075*** [0.024]	0.003 [0.018]
Differentiation	0.027** [0.013]	0.055*** [0.017]	0.020 [0.013]	0.038 [0.030]	0.063* [0.035]	0.040 [0.027]	0.034** [0.017]	0.068*** [0.023]	0.017 [0.017]
<i>Expected benefits</i>									
Technological	0.398*** [0.009]	0.150*** [0.012]	0.521*** [0.009]	0.317*** [0.019]	0.117*** [0.025]	0.503*** [0.017]	0.434*** [0.012]	0.175*** [0.016]	0.558*** [0.012]
Non-technological	0.229*** [0.008]	0.127*** [0.011]	-0.479*** [0.008]	0.252*** [0.020]	0.146*** [0.026]	-0.467*** [0.017]	0.205*** [0.011]	0.121*** [0.015]	-0.494*** [0.011]
<i>Controls</i>									
Employees: _1_9	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
_10_49	0.060*** [0.014]	0.028 [0.019]	-0.050 [0.014]	0.048 [0.034]	0.003 [0.045]	-0.077** [0.030]	0.070*** [0.019]	0.026 [0.025]	-0.048** [0.019]
_50_249	0.049*** [0.018]	-0.074*** [0.024]	-0.060*** [0.018]	0.047 [0.040]	-0.068 [0.053]	-0.061* [0.036]	0.083*** [0.025]	-0.069** [0.033]	-0.056** [0.025]
_250+	0.071*** [0.027]	-0.170*** [0.036]	-0.059** [0.027]	0.080 [0.056]	-0.201*** [0.074]	-0.109** [0.050]	0.093** [0.037]	-0.125** [0.050]	-0.061* [0.036]
Young (after 2007)	0.053*** [0.018]	0.051 [0.023]	-0.021 [0.017]	0.081** [0.040]	0.093 [0.061]	0.009 [0.041]	0.046** [0.022]	0.078*** [0.030]	-0.006 [0.022]
Group	0.015 [0.016]	-0.035* [0.021]	-0.031** [0.015]	-0.026 [0.033]	-0.077* [0.043]	-0.039 [0.029]	0.037* [0.021]	-0.046* [0.028]	-0.053*** [0.020]
International	0.021 [0.017]	-0.024 [0.023]	0.060*** [0.016]	-0.037 [0.031]	-0.089** [0.041]	0.047* [0.028]	0.066*** [0.023]	0.013 [0.031]	0.081*** [0.023]
Access to credit	0.013*** [0.002]	-0.002 [0.002]	-0.012*** [0.002]	0.011*** [0.004]	0.003 [0.005]	-0.005 [0.003]	0.016*** [0.002]	-0.007** [0.003]	-0.013** [0.002]
Constant	-0.868*** [0.145]	0.647*** [0.192]	0.853*** [0.141]	-0.593* [0.300]	0.329 [0.440]	0.340 [0.296]	-1.020*** [0.195]	0.926*** [0.261]	0.816*** [0.195]
<i>Industry dummies</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Country dummies</i>	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	9,679	9,679	9,679	2,007	2,007	2,007	5,425	5,425	5,425
F-statistics	146.4	19.4	103.8	34.5	15.3	29.1	108.2	18.3	72.4
Adj R ²	0.475	0.153	0.389	0.429	0.137	0.386	0.471	0.143	0.372

Note: Two-step standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Second step: The probability to innovative.

	(1) All sample	(2) Manufacturing	(3) Services
<i>Intangible investments</i>			
RESINT (Resource intensity)	0.085 [0.298]	0.789** [0.387]	0.018 [0.315]
INTDEV (Internal development)	1.607** [0.059]	0.428 [0.800]	1.564** [0.648]
TECINT (Technological intangibles)	0.167*** [0.059]	0.320*** [0.096]	0.126* [0.068]
<i>Controls</i>			
Employees			
_1_9	Reference	Reference	Reference
_10_49	0.041 [0.045]	0.081 [0.087]	0.054 [0.058]
_50_249	0.260*** [0.088]	0.042 [0.125]	0.300*** [0.105]
_250+	0.472*** [0.161]	0.154 [0.244]	0.456*** [0.162]
Young (after 2007)	-0.131** [0.058]	-0.024 [0.120]	-0.193** [0.078]
Group	0.204*** [0.057]	0.207** [0.096]	0.269*** [0.077]
International	0.074 [0.057]	0.067 [0.094]	0.011 [0.071]
Access to credit	-0.021*** [0.008]	-0.053*** [0.010]	-0.009 [0.012]
Constant	0.281 [0.854]	3.188*** [0.996]	-0.661 [1.129]
Industry dummies	Included	Included	Included
Country dummies	Included	Included	Included
Observations	9,679	2,007	5,425
χ^2	753.04	271.13	436.31
Wald test of exogeneity	107.82	42.25	50.82
Overid (pval)	0.765	0.663	0.517

Note: Two-step standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the null hypothesis of no endogeneity in all the specifications used.⁹ The main explanatory variables turn out to be affected by an endogeneity problem and the choice of our two-stage econometric model appears thus supported.

4.1. First stage: instrumented intangible variables

Table 3 shows the outcome of the first stage equation in aggregate terms (Block I) and for Manufacturing and Services (Blocks II and III). In general, it emerges that the selected instruments are correlated with the three intangible variables to a good extent. Furthermore, the application of the Amemiya–Lee–Newey test for over-identifying restrictions does not reject the null hypothesis of instruments validity, thus supporting our claim that the chosen instruments are uncorrelated with the error term of the second stage regression: *Overid* at the bottom of Table 4 reports the p-value of the test.

Table 3 also shows that the instruments' behaviour does not deviate systematically from our theoretical argumentation (Section 3.3). Although the relative coefficients can at most be taken as suggesting correlations among the variables at stake, rather than as proper causal

⁹At the bottom of Tables 3 and 4, we report the F statistics for the Wald test of exogeneity, the hypothesis of no endogeneity is always rejected at the 1% level.

relationships, the results of the instrumentation provides us with interesting insights that deserve attention.

As expected, given the search for a cost advantage that it entails, pursuing a price strategy generally shows a negative correlation with our three intangible variables. In particular, the intensity of the resources dedicated to intangibles decreases the most significantly for price-oriented firms in services, while it does not in manufacturing, where consistently it does not increase either. In all the blocks, a price strategy is consistently associated with a greater resort to external intangibles (negative correlation with internal ones), as cheaper intangible providers on market could represent the basic issue in this case. Still as expected, with this business priority, investments in technological intangibles become less pivotal in manufacturing, and only neutral (not significant) in services and overall.

The three intangible variables show an expected general positive correlation with a differentiation strategy. The only exception is represented by technological intangibles in all the three blocks, suggesting that the quality premium that the strategy entails could be linked to other softer organisational aspects than technological ones. Furthermore, in manufacturing, a differentiation strategy appears exclusively related with the internal development of intangibles, irrespectively also from their intensity.

The behaviour of the other two instruments, related to the expected benefits of intangible investments, is fully theoretically consistent in all the three blocks. First of all, the longer the time horizon along which firms expect to benefit from their intangibles, the more intense the firms' investments (i.e. resource intensity): that is, the more firms retain intangibles strategically for a competitive advantage, which is sustainable over time. This holds true for both technological and non-technological expected benefits.

The significantly positive correlations between technological and non-technological expected benefits, on the one hand, and the internal development of intangibles, on the other hand, are also theoretically consistent. The greater the benefits of an extra year of economic returns, the more firms are inclined to develop their intangibles in a more appropriate organisationally embedded way. This holds true both in manufacturing and in services.

Finally, in theoretically and internally consistent way with the responses of the surveyed firms, investing in technological intangibles is positively (negatively) correlated with their own (their complement) expected benefits: that is, technological (non-technological) expected benefits.

All in all, the results of Table 3 appear to confirm our theoretical framework of the firms' decision to invest in intangibles, which is consistent in manufacturing and services firms. In general, theoretically consistent are also the correlations between the three regressors and the considered controls. Indeed, although some correlations are unexpected (e.g. internationalised firms do not show higher investments in intangibles than other firms, apart from services), they are however accountable by considering the heterogeneity of the assets that the three intangible variables incorporate.

4.2. Second stage: intangible investments and the firm's propensity to innovate

Coming to the results on the innovation impact of the instrumented intangibles, Table 4 reports them for the whole sample (Column 1) and for Manufacturing and Services separately (Columns 2 and 3).

In aggregate terms (Column 1), a first striking result emerges: once we control for the other strategic aspects of intangible investments, their resource intensity does not significantly impact the firm's probability to innovate, thus leading to reject our Hp1 for the whole sample. In principle, this would seem to contradict our resource-based view approach, apparently denying the relevance of knowledge-based assets for the sake of innovation. However, a closer scrutiny of our focal regressors leads to conclude that this is a misleading interpretation. A more accurate one would say that the firm's propensity to innovate actually depends on intangibles, but not on the amount of resources generally invested in them. Indeed, the significance of *INTDEV* and *TECINT* in the aggregate estimates suggests that innovation rather depends on the amount of the resources invested in specific technological intangibles and, above all, built up internally.

Indeed, the non-significance of *RESINT* actually leads us to automatically support with respect to the entire sample our Hp2 about the greater innovative importance of what we called technological intangibles with respect to intangibles overall. In interpreting this result, we should keep in mind that our application focuses on a technological kind of innovation, represented by the introduction of new or improved products/services and processes.

It is therefore consistent to find this innovation outcome depending on a regressor (*TECINT*), which synthetically accounts for the most typical of its inputs: R&D, software and design.¹⁰

As a matter of fact, in the relevant literature, the other group of intangibles that we have dealt with—training, reputation and branding and organisation or business process improvements—are retained to have a more direct impact on the non-technological innovations of the firm: one just needs to think of the relationship between reputation/branding and marketing innovations, or between training and organisational innovations. At most, the impact of non-technological intangibles on technological innovations is indirect and passes through their contribution to the firms' management of internal and external knowledge.

The non-significance of *RESINT* in Column 1 also leads to accepting our Hp3 in the aggregate, when we consider that the calculated marginal effect of *INTDEV* (0.409) is greater than that of *TECINT* (0.039) and of *RESINT* (non-significant). In general, the innovation impact of intangibles appears mainly related to a make-or-buy choice of the firm. Increasing the intensity of investments in technological rather than non-technological intangibles (and in intangibles overall) has a lower impact on the probability of introducing an innovation than increasing the resort to internal intangibles.

This is an extremely important outcome of our analysis. On the one hand, it confirms the perils that the extant literature has identified in the decision to externalise resources, which are non-easily contractible and/or strategic for its competitive advantage like intangibles. Following an evolutionary perspective (Mahnke 2001), for example, it has been claimed that an internal (rather than external or outsourced) approach to the development of intangibles prevents their leakage to the firms' rivals and, above all, enables the firm to build successful organisational routines and core competencies within them. As we said, this has led to a research stream in innovation studies, which has shown that moving the development

¹⁰It should be noted that orientation towards technological intangibles may be expected to be more important for manufacturing firms while an orientation towards internal development may have a stronger influence on innovation propensity in services firms. Indeed, as shown by Evangelista (2000), R&D activities play an important role for innovation only in science and technology-based service industries.

of intangible (and tangible) activities across the firms' boundaries (that is, outsourcing them) could have effects, although not unambiguous, on its innovation performance (e.g. Robertson and Langlois 1995; Mazzanti, Montresor, and Pini 2007). On the other hand, the result relative to *INTDEV* has also implications for the specific strand of literature on intangibles. In this literature, the volume of the firms' investments is usually the exclusive focus of the analysis and the quantification of the so-called 'own-intangibles' of the firm is extremely problematic following the current accounting standards (Lev 2001).

The results obtained with respect to the entire sample find some interesting exceptions when we consider the estimates for Manufacturing and Services separately. First of all, Hp1 returns to hold true for manufacturing firms, for which *RESINT* is significant (Column 2). When the knowledge embodied in intangibles is used to obtain tangible goods, with respect to which the opportunities of economies of scale are possibly greater, also the scale of intangible investments matters. To be sure, it seems to matter even more than the resources invested in technological intangibles (the marginal effects are 0.242 and 0.098, respectively). In spite of the expected significantly important role that technological intangibles have in manufacturing, Hp2 is not confirmed. Finally, *INTDEV* loses its significance for manufacturing companies, rejecting Hp3 and suggesting a possible greater propensity of industrial firms of fragmenting their value chain and managing those drawbacks of outsourcing (even intangibles) that make *INTEDV* significantly positive otherwise.

Coming to services (Column 3), results are quite aligned with the aggregate ones: Hp1 is still not confirmed, while Hp2 and Hp3 hold true. To be sure, the greater importance of the internal development of intangibles with respect to the investment in technological intangibles (the marginal effects are 0.402 and 0.032, respectively) appears this time due (also) to a lower significance of *TECINT* in accounting for innovation in services: a result that appears consistent with the crucial role that intangible inputs like training, reputation and branding and organisation and business processes have in getting and supplying an intangible kind of output like a service.

Looking at the controls, standard results of the innovation literature are generally confirmed. Among the exceptions, the correlation between credit access and innovation shows a weird negative sign, for which our rough and tentative explanation is that firms in countries with more accessible credit could be inclined to engage in 'riskier' innovative projects, with higher potential benefits but, *ceteris paribus*, with a lower probability of success. Unfortunately, our survey does not allow us to test this hypothesis.

Following the considerations we presented at the end of Section 3.1, the post-crisis temporal context in which the respondent firms were interviewed may also explain this result, although with a somehow opposite argument to the previous one: that is, the particular situation of the business cycle might have pushed firms with more accessible credit to move resources to activities not directly related to technological innovation.

4.3. Robustness checks

In concluding the illustration of the results, as a sort of robustness check, we present the estimates of an alternative specification of our model (1), in which intangibles are considered, rather than in the three theoretical dimensions we have focused in Section 2, in those that emerge 'endogenously' from the data.

In order to do that, we have first run a principle component analysis (PCA) on the 12 intangible variables that measure the firm's involvement in the 6 intangibles at stake: 6 with respect to internal and 6 with respect to external resources. As Table A1 in the Appendix shows, most of the variance (i.e. about 64%) is accounted by three components that, quite interestingly, appear easily associable to our three original intangible variables (see Table A1 in Appendix A).

Indeed, the first component is positively correlated with the resources allocated to all of the six intangibles, irrespectively from their development (internal or external), and can thus be taken to represent the intensity of the relative firm's investments. The second component is positively (negatively) associated with a higher use of internal (external) resources and competences for the relative investments, and can thus be taken to represent their internal development. Finally, the third component appears to discriminate between technological and non-technological intangibles, as it is positively (negatively) correlated with software, R&D and design (training, reputation and branding and organisation and business processes).

This descriptive analysis provides us with reassuring arguments about our three main independent variables: indeed, not only are they focal from a theoretical point of view, but also empirically. On this basis, although with some benefit of hindsight, given the overlapping of loading that the 12 original variables show across the 3 components, we have replicated the two-step estimates with respect to them.

Table 5. Second step: The probability to innovative using factors from a PCA.

	All sample	Manufacturing	Services
<i>Intangible investments</i>			
RESINT	0.166***	0.330***	0.142**
(Resource intensity)	[0.062]	[0.090]	[0.067]
INTDEV	1.251***	0.428	1.177***
(Internal development)	[0.482]	[0.625]	[0.452]
TECINT	0.144***	0.258***	0.109*
(Technological intangibles)	[0.051]	[0.082]	[0.056]
<i>Controls</i>			
Employees			
_1_9	Reference	Reference	Reference
_10_49	0.026	0.074	0.042
	[0.045]	[0.086]	[0.057]
_50_249	0.234***	0.039	0.270***
	[0.080]	[0.119]	[0.095]
_250+	0.453***	0.160	0.427***
	[0.154]	[0.243]	[0.151]
Young (after 2007)	-0.123**	-0.035	-0.171**
	[0.057]	[0.123]	[0.073]
Group	0.200***	0.206**	0.261***
	[0.055]	[0.097]	[0.073]
International	0.080	0.066	0.020
	[0.058]	[0.096]	[0.070]
Access to credit	-0.021***	-0.053***	-0.010
	[0.008]	[0.010]	[0.011]
Constant	1.316*	4.031***	0.439
	[0.750]	[0.969]	[0.977]
Industry dummies	Included	Included	Included
Country Dummies	Included	Included	Included
Observations	9,679	2,007	5,425
χ^2	768.01	271.13	436.31
Wald test	109.06	42.25	50.82
Overid (pval)	0.766	0.663	0.517

Note: Two-step standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Quite interestingly, the results of the instrumentation of the three components (stage one), carried out with the same set of instruments of Section 3.3, appear consistent with those we have illustrated above (results available from the authors on request). What is more, as Table 5 shows, also the results of the analysis of their innovation impact appear relatively robust with respect to our benchmark estimates.

With respect to the whole sample (Column, 1), Hp3 is still confirmed (the marginal effects of *RESINT*, *INTDEV* and *TECNINT* are 0.043, 0.324 and 0.037, respectively), providing support to one important result of the paper. Also Hp1 holds true, where Hp2 is somehow rejected, as there are no significant differences in the effects of *RESINT* and *TECNINT*. Once again, manufacturing (Column 2) is marked by the non-significance of *INTERDEV*, which still leads to reject our Hp3 in this macro-sector and, given the size of the relative marginal effects (*RESINT* 0.101 and *TECNINT* 0.079), also our Hp2. Finally, while *RESINT* returns significant also for services (Column 3), providing an additional support to Hp1, the still low level of significance for *TECNINT* and the higher marginal effects of *INTDEV* (0.313 vs. 0.029) confirm the support to Hp2 and Hp3 in this macro-sector.

Overall, the results of our estimates appear robust in the sense specified above and lead to crystallise a final picture on whose implications we can move in the next section.

5. Conclusions

Intangibles are assets whose economic impact depends on the complex decisional process through which firms invest in them. This is the premise of a flourishing literature that is trying to plug intangibles into productivity growth analysis, at both macro- and micro-levels. Rather unfortunately, such a starting point is missed in innovation studies, in which for both theoretical (the dominance of the KPF view) and empirical (the pervasive resort to CIS data) reasons, intangibles are usually taken in a relatively compact way and by neglecting their strategic antecedents.

Drawing on the resourced-based view, in this paper, we have extended the standard KPF approach to intangibles and, taking the opportunity of a recent European survey on firms' decisions to invest in intangibles (the Innobarometer 2013), we have tried to fill this gap and reconcile productivity and innovation analysis. In particular, we have put forward some research hypotheses about the innovation impact that different aspects of intangible investments have and submit them to empirical testing on a wide sample of countries and coverage of industries (distinguishing by manufacturing and services).

The results we have obtained lead us to important implications. In spite of the specificities that emerge by considering manufacturing and services separately, the decision to invest in intangibles is consistent with the business priority of the investing firm and with the expected duration of their benefits. These strategic elements thus need to be taken into account explicitly. Once this is done, as we have suggested with our empirical methodology, the innovation impact of intangibles appears strategic too.

First of all, strategic considerations emerge with respect to the kinds of intangibles that have an innovation impact for the firm. The firms' innovativeness increases by increasing the resources allocated to intangibles, whose higher technological content makes more functional and more easily applicable to the development of new products/services and processes: that is, technological innovations. Quite interestingly, this holds true for both manufacturing and services, in spite of their allegedly different innovation patterns, providing an

element of convergence between them (Tether 2005). This result has evidently an important implication in strategic and policy terms. Managers and policy-makers should more directly retain that intangibles are not all equal, and that specific kinds of innovation map into specific kinds of intangibles, irrespectively from the kind of macro-sector firms operate in.

An even more strategic result emerges by looking at the intensity and origin of the resources used for intangibles. Overall, investing more in intangibles does not boost firms' innovativeness per se, while their choice to dedicate internal resources and competences to the development of intangibles actually do so. This is particularly the case of service firms, whose innovation appears actually 'dependent' on an in-house policy of intangibles. Conversely, for manufacturing firms, the opposite holds true, as having larger amounts of resources in intangibles is more important than having them in-house for the sake of innovation. In this last respect, manufacturing and services return to diverge, possibly because of their different exposition to, and capacity of managing externalisation processes (Ten Raa and Wolf 2001). This result has also important strategic and policy implications. On the one hand, managers should be cautious in leaving the development of intangibles to external providers (outsourcing them), particularly in services, as their innovative development largely depends on specific capabilities that are different and not easily replicable by the market. On the other hand, policy-makers should consider the lack of internal competences and resources as a serious failure to be addressed to foster innovation and competitiveness, still with respect to services in particular. Addressing the difficulties (service) firms face in accessing the market for intangibles through innovation cooperation and technology transfer thus becomes a relevant issue in innovation policy. With respect to manufacturing, instead, the issue is that of providing firms with suitable incentives to reach the scale of intangible investments that, overall, allow them to be innovative.

In conclusion, we should of course recognise that our study is not free of limitations. As we said, the most relevant one stems from the cross-sectional nature of the data-set, posing a risk of endogeneity in the regressors, which we have tried to accommodate at best giving the data at hand. A second set of limitations is related to the nature of the Innobarometer 2013 survey that we have used. Among others, it should be kept in mind that the amount of resources that firms have declared that they invest in intangibles, internally and externally, is only a proxy of the actual and accounted investments firms report. Similarly, the expected benefits that they have indicated in terms of years do not necessarily correspond to those in which they capitalise the relative expenditures, when they actually do so. Still, these are the best proxies that a Flash survey like the Innobarometer can manage to obtain. Its eventual integration with other company data could, of course, make the indications and insights that we have obtained definitively sounder.

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Appendix A.

Table A1. Principal component analysis of expenditures in intangibles using internal and external resources and competencies (% of total turnover).

	Component 1	Component 2	Component 3
<i>Internal investments</i>			
Training	0.295***	0.297***	–0.381***
Software	0.269***	0.295***	0.243***
Reputation/brand	0.276***	0.200***	–0.343***
R&D	0.294***	0.259***	0.376***
Design	0.257***	0.377***	0.389***
Organisation/business	0.282***	0.343***	–0.272***
<i>External investments</i>			
Training	0.300***	–0.220***	–0.344***
Software	0.280***	–0.261***	0.144***
Reputation/brand	0.300***	–0.283***	–0.178***
R&D	0.303***	–0.297***	0.264***
Design	0.299***	–0.312***	0.248***
Organisation/business	0.306***	–0.274***	–0.097***
Eigenvalues	4.796	1.367	1.040

*** $p < 0.01$ —The three components explain about 64% of the variance of the original variables. Commonly with other empirical applications, components with an eigenvalue greater than 1 are considered.