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Intangible investments and innovation propensity. Evidence from the Innobarometer 2013

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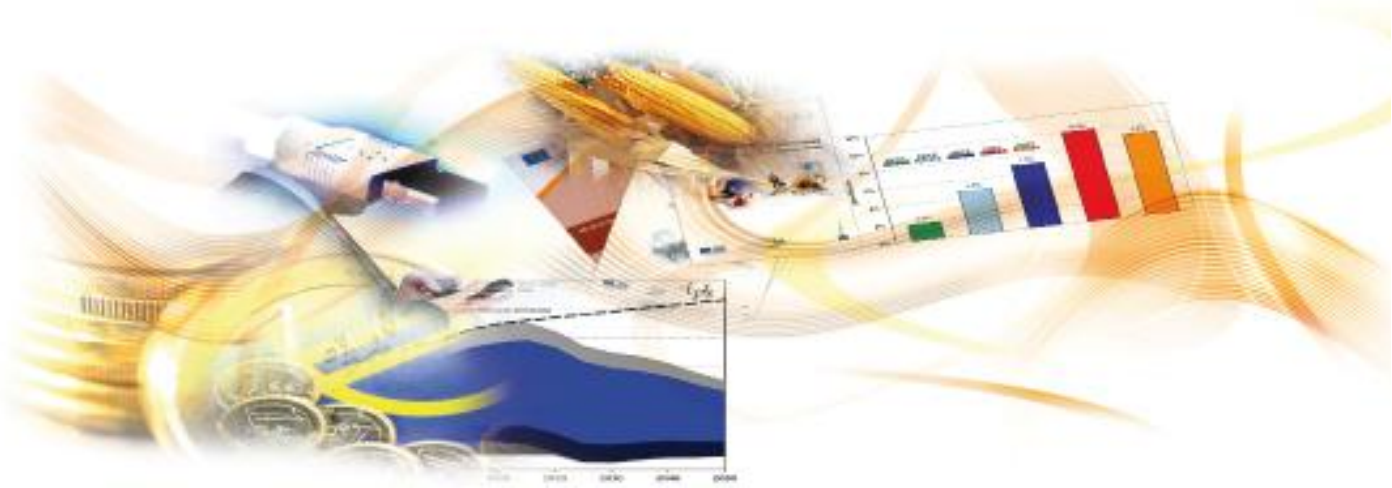
Intangible investments and innovation propensity. Evidence from the Innobarometer 2013

Sandro Montresor and Antonio Vezzani

2014



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Abstract

This paper investigates the innovation impact of intangibles by considering the decision of firms to invest in a comprehensive set of them. By using a new survey on a large sample of firms in 28 EU (plus 8 non-EU) countries, we first identify the principal components of the resources firms invest in six kinds of intangibles. Their contribution to the firms' propensity to introduce new products and/or processes is then estimated with a two-step model, which addresses the endogeneity of the focal regressors through theoretically consistent instruments. A firm's innovativeness depends on its choice of using internal vs. external resources for its intangible investments more than on their actual amount, and on the kind of assets these investments are directed to. Intangibles need to be managed strategically in order to have an innovation impact and the policy support of this type of investment must take this strategic use into account.

Keywords: Innovation; Intangibles; R&D.

JEL Classification: *030; 032; 033.*

1 Introduction

The role of intangibles in driving firms' innovation has been widely claimed, in both the academic and the policy realm. Not only is R&D a crucial innovation input, but also other non-R&D intangibles provide firms with knowledge that facilitates the different phases through which innovation eventually occurs as well as its different dimensions. The "system approach" to innovation (Carlsson et al., 2002) and, more recently, the so-called "open-innovation mode" (Chesbrough, 2003) have extensively argued that the innovation process is much less "R&D-centric" than the standard "linear model" suggests and pointed to additional factors through which firms can introduce both technological and non-technological innovations: training, design, reputation and branding, are just few examples. In the EU, Scoreboard analyses of the Innovation Union and new synthetic indicators of innovation are also inspired by the importance of firms' intangibles. The recent initiative "Design for Innovation", supported by the European Commission (DG Enterprise and Industry), and the OECD Project "New sources of growth: Knowledge-based capital" are important examples of the current policy focus on intangibles.

In spite of their wide relevance, a comprehensive account of intangibles is missing in innovation studies. Unlike in growth-accounting exercises at a macro-economic level, and in microeconomic studies on productivity drivers, micro-analyses of innovation generally focus on one, or at most a few, intangible at a time. While they sometimes address the complementarity between different intangibles, they often fall short of recognising the full spectrum of intangible activities, to which firms can resort to for increasing their innovativeness. Furthermore, very few of the factors that productivity studies have found to be important for the decisional process that leads firms to invest in intangibles have been translated into innovation studies. In general a firm's investment decision in intangibles is treated as exogenous, without considering the strategic role it attaches to these assets, the life expectancy of their benefits, and the "organisational mapping" (e.g. in dedicated organisational departments/divisions) of different intangibles within the firm. The extensive use of the Community Innovation Survey (CIS), where intangibles are treated as activities in which enterprises might have engaged for innovating, is both a cause and an effect of this "partial" analysis of the actual link between intangibles and innovation.

In this paper we contribute to filling these gaps, by recovering the investment nature of a comprehensive set of intangibles in the analysis of their innovation impact. As a further element of originality, we do that with respect to a large sample of European and non-European firms, in both manufacturing and non-manufacturing sectors, interviewed for the Innobarometer-2013. This extensive focus is an additional novel element in comparison to studies that focus on a specific category of intangibles (e.g. training rather than design), in specific sectors and countries.

The rest of the paper is organized as follows: Section 2 illustrates the theoretical background; Section 3 describes our employed dataset and econometric strategy; Section 4 discusses the estimation results and draws some policy implications on its basis; Section 5 concludes.

2 Theoretical background

Intangible assets have a significant impact on several dimensions of economic performance, starting with productivity.[1] At a macro-level, a recent stream of growth-accounting exercises, stimulated by the seminal work of Corrado et al. (2005) on the US, has shown that "computerised information", "innovative property", and "economic competencies" explain a greater share of labour-productivity growth than tangible capital, as well as a more rapid increase of it over time in a number of countries.[2] In these studies, intangibles are understood according to the so-called CHS (Corrado-Hulten-Sichen) classification, which refer to three quite broad and heterogeneous categories. In brief, "computerised information" refers to "knowledge embedded in major component, computer programs and computerised 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 et al., 2005, p. 23).

At a micro-level, the productivity impact of intangibles has also emerged following the so-called "knowledge-capital model", stimulated by Griliches's (1998) seminal contribution. This has translated in the estimation of a firm's knowledge production function (KPF), whose

[1] In addition, evidence has been obtained with respect to, among the others, the firm's financial stock value (Hall et al., 2005; Sandner and Block, 2011) and its internationalization strategies (Denekamp, 1995; Delgado-Gómez et al., 2004).

[2] Following and extending the research carried out on the UK (Marrano et al., 2009; Borgo et al., 2012), evidence of that has been found across different European countries by Framework Research Projects like INNODRIVE, COINVEST, INDICSER and IAREG.

standard inputs (physical capital and labour) have been augmented with R&D, human and organisational capital, to mention a few (e.g. Bontempi and Mairesse, 2008; O'Mahony and Vecchi, 2009). In all of these studies, the intangibles-productivity nexus is also explained by the role of technological and non-technological knowledge, which firm acquires by investing in them, for the introduction of innovative products/services and business processes: in brief, the innovation impact of intangibles.

2.1 Intangibles categories and innovation

In spite of this important economic background, quite surprisingly, the relationship between intangible investments and innovation has received only partial attention in innovation (economics and management) studies. First of all, empirical analyses have focused on one, or at most a few, intangible at a time, among those identified by the various extant classifications. If, for example, we refer to the taxonomy elaborated by NESTA within the

"Innovation Index Project", to which the majority of the business surveys on the field - including our own empirical application (see Section 3) – refer to, we can immediately realise that the attention on intangibles has so far been heterogeneous.[3] Out of the six intangibles that such a classification identifies[4], (i) *investments in R&D* have definitely received most of the attention, both because of their primary role of innovation input (Mansfield, 1984; Mairesse and Mohnen, 2005), and because of the large availability of national R&D business surveys for investigating their direct and indirect (e.g. through absorptive capacity and spillovers) innovation impact (Cohen, 2010).

The analysis of other "non-R&D" innovation drivers has instead proceeded more sluggishly and with non-systematic studies of their combined role. Amongst others, different kinds of business surveys and official statistics, both in Europe and in the US, have enabled the attainment of important results on the innovation impact of the "computerised information" that firms can obtain through (ii) investments in *software development,* as a distinct activity from their standard R&D. These investments could end up leading the firm to actual "software-innovations". Furthermore, they could interact with, and affect the diffusion of, software

[3] More precisely, the classification was put forward by NESTA, as an extension of the CHS one, for the business survey "Investment in Intangible Asset" (IIA), for which it was commissioned by the UK Office for National Statistics (ONS). Launched for the first time in October 2009 (Awano et al., 2010), largely profiting from the contribution of some leading economists in the UK, its main aim was to survey a wider range of spending on intangibles, compared to traditional sectoral surveys (like those on R&D, ICTs, etc.).

[4] That is, training, software development, company reputation and branding, Research and Development (R&D), design of products and services, organisation or business process improvements. These are listed in Q2 of the questionnaire used for our study, in Appendix B.

products within the firm and of ICT technologies in general. In so doing, they stimulate changes in both the firm's organisation/management and in its technical practices (Quintas, 1994), thus increasing its general innovative profile (Higón, 2012; Gago and Rubalcaba, 2007). A similar manifold impact concerns the firm's (iii) investments *in training,* the combination of this with ICT and workplace organisation investments stimulating a still vivid research stream (Lynch and Black, 1998; Bresnahan et al., 2002). Other research streams have also drawn attention towards this same kind of training investments, these being a crucial determinant of the firm's human capital and having a great impact on both the firm's innovation and profitability (e.g. Bontis and Fitz-Enz, 2002). In an extreme nutshell, training increases both the skills of the workforce and their capacity to stimulate innovation through learning-by-doing, and the capacities of entrepreneurs to capture new opportunities in breakthrough innovations (e.g. Freel, 2005; Marvel and Lumpkin, 2007). A combined attention for R&D, software (or ICT in general) and training in driving firms' innovation has also been stimulated by the recent evolution of

systematic national and international innovation surveys (e.g. in the CIS), though more discontinuously in Europe than in the US (e.g. Ciriaci, 2011b). Within the framework of the same surveys, the role of (iv) investments in *design* has also started emerging (e.g. Ciriaci, 2011a), though still to a limited extent with respect to the attention that it has been attracting in innovation studies. In the latest extant research, design is actually emerging as a pivotal element of any innovation (e.g. Candi, 2006; Verganti, 2008), given its manifold role in shaping the technological choices of the firm (for example, with respect to modular or non-modular products), identifying and possibly shaping the consumers' needs (through actual "stylistic innovations"), affecting the firm's training choices (e.g. towards design-specific skills), and reconfiguring the labour division in the firm's organisation and value chain (D'Ippolito, 2014; Ravasi and Stigliani, 2012).

Of the remaining parts of the classification in question, (v) investments in *organisation and business processes* have also received attention for the sake of innovation. This spans from their role in building up corporate operating procedures, routines and scripts, in which innovative knowledge can be codified, stored and integrated (e.g. Carmona-Lavado et al., 2010; Hsu and Fang, 2009), to their input function for building up an organisational capital, which is rather embedded in the firm's managers and employees and thus measurable by looking at their competencies and tasks (Squicciarini and Le Mouel, 2012). Finally, in spite of their prominent role in the firm's value in the business accounting literature, (vi) investments in

branding and reputation seem to be "[t]he forgotten dimension of innovation" (Aaker, 2007, p.8), given the unfortunate neglect of their crucial returns in increasing the credibility, the legitimacy, and the visibility of an innovation (e.g. Wong and Merrilees, 2008).

As this inevitably superficial and partial review suggests, all of the six intangibles, and possibly others of alternative classifications (for a review, see Choong 2008) constitute a spectrum of activities that firms can use to a different extent for their innovation efforts: both at the intensive margin - that is, by deepening the investments in one or another kind of intangible asset - and at the extensive margin - that is, by focusing or widening their involvement in a potential portfolio of intangibles. The lack of a comprehensive analysis of their innovation role - as we said, mainly due to the lack of proper data - appears unfortunate and represents a first gap that this paper aims to fill.

2.2 Intangible investments and innovation

A second gap that this paper addresses concerns the limited attention that innovation studies have in general dedicated to the *investment* decisional process; through which intangible assets are built up. Indeed, the relevant decisions are usually taken as exogenous, by treating intangibles either as a flow or, at most, as a stock variable. This is to us doubly unfortunate. Firstly, from a conceptual point of view, important information is lost about the innovation impact of the strategic choices that firms make about their intangibles. The first of them is of course represented by the amount of resources (and possibly competencies) that the firm dedicates to its intangibles, rather than to tangible assets (or other alternative uses): in brief, the *intensity* of the *resources* allocated to intangibles. Firms' monetary and non-monetary resources are in fact limited and, in the presence of budget constraints and potential conflicts among the organisational units involved in the relative decisions, this allocation is an important aspect in which the strategic intent of the firm translates (Andreou and Bontis, 2007; Pike et al., 2005).

A second investment dimension with the utmost relevance to innovation is represented by a firm's choice to allocate some of its resources to "making" *(internally)* rather than "buying" *(externally)* those intangibles. As recent empirical evidence has shown (e.g. Arrighetti et al., 2013), factors internal to the firm are actually the most important in accounting for the heterogeneity that firms show with respect to their investments in intangible assets, even within the same industry. In this vein, making rather than buying intangibles could be a

strategic choice: from both a contractual perspective, as markets might not exist, or do not work efficiently in trading intangibles (Williamson, 1981; Biondi and Reberioux, 2012); and from a resource/competence based one, given that intangibles often represent the core-competencies of the firm, whose internal control is necessary for making them a source of competitive advantage (Barney, 1991; Arnold, 2000).[5]

Last, but not least, a firm's investment strategy of course affects its decision about the *specific intangible,* or kind of intangibles, in which to invest. In this last respect, the distinction between intangible assets that are internally generated and externally acquired is directly related to the extent to which intangibles can be actually separated from the firm's organisation. A related

classification actually refers to the ease of establishing rights of control over intangibles, for which markets exist to a different extent (Ashton, 2005). For tacit knowledge generated by business secrets and reputational capital, for example, legally-enforceable property rights hardly exist, but the firm can be assumed to have the control of them. Conversely, with respect to human and organisational capital, for which markets still do not exist, the firm has little, if any, control in relation to "its" workers and stakeholders, respectively, and their transfer can only occur through that of the company itself. A possibly more relevant distinction for our issue at stake is entailed by the different kinds of innovations that firms can introduce. In particular, different intangibles (e.g. in terms of their content of scientific vs. non-scientific knowledge) are required by technological (i.e. new products and/or processes) rather than non-technological innovations, such as those represented by changes in the firm's organisation (e.g. the introduction of team work or of job rotation in the firm) and marketing strategies (e.g. the resort to a different pricing and/or advertising channel for its existing or new products) (Evangelista and Vezzani, 2010).

The previous and other elements of differentiation of course have a crucial impact on the firm's incentives to invest in different intangibles, as well as on its capacity to get a competitive advantage from their exploitation. Accordingly, a comprehensive analysis of a set of intangibles appears as important as one dedicated to the specific typologies of them.

All of these three investment aspects also have an important empirical relevance, which is the

[5] By the same token, the external development of intangibles could turn out to be a strategic decision when the previous contractual and non-contractual risks are absent and/or when intangibles are not pivotal for the firm's strategy itself.

second reason of concern for their neglect. Indeed, without accounting for the strategic aspects and determinants, a critical problem of reverse causality (and endogeneity) could emerge, in which innovation could explain intangibles equally well, rather than the other way round.

All in all, a firm's investments in intangibles largely represent a crucial aspect to retain in investigating its innovation, and will be thus addressed in our empirical application.

3 Empirical application

3.1 Dataset: 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 et al., 2014).[6]

Drawing on previous surveys on intangibles in individual countries, mainly the NESTA IIA for the UK, the Innobarometer-2013 was designed to perform a systematic investigation of firms' investment decisions in six intangibles (the same as the NESTA UK-IIA classification): i) training, ii) software development, excluding research and development and web design, iii) research and development; iv) design of products and services (excluding research and development); v) company reputation and branding; vi) organization or business process improvements. With this purpose, the survey was submitted to a (realised) sample of 11,317 enterprises with at least one employee, in the EU28 and in other 8 non-EU countries (see Table A.1 in Appendix A and http://ec.europa.eu/enterprise). Questions (see Appendix B) 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).

The Innobarometer-2013 represents a unique multi-country, micro-survey on intangibles, with some relevant original features. In particular, although aimed at collecting almost exclusively "qualitative data", the questionnaire reports the percentage of firms' turnover as a reference to proxy intangible-related costs. Another peculiar feature is the distinction between "internal" and

[6] Conducted at the request of the Directorate-General for Enterprise and Industry, the survey was carried out by TNS Opinion & Social network, under the coordination of the Directorate-General for Communication ("Research and Speechwriting" Unit) and with the contribution of the Joint Research Centre of the European Commission. Each and every year, the Innobarometer intends to report "an annual opinion poll of businesses or general public on attitudes and activities related to innovation policy. [...] It provides policy relevant information direct from business or the general public which is not available from other sources" (DG Enterprise & Business web-site).

"external" resources and competencies to invest in intangibles.

In spite of these and other elements of originality, the Innobarometer-2013 presents some specific characteristics that require caution in using the relative data. Firstly, it is a Flash survey, carried out with CATI methodology, so that its results should be interpreted taking into account the fact that concepts and definitions had to be delivered to respondents in a concise and

straightforward way, with some risk of a systematic response bias. Secondly, the fact that the reference population is represented by several millions of enterprises from 36 countries means that high sampling rates or detailed industry/size stratifications are not possible (with the exception of the largest EU countries).[7] This could affect the level of precision of the results, unless the presence of potential groups of outliers is properly controlled for.

All of the previous considerations recommend caution in applying the data from the Innobarometer-2013. However, as has been shown in Montresor et al. (2014), these problems are not prohibitive for their statistical and econometric analysis and will be thus used as described in the following section.[8]

3.2 Econometric strategy and variables

The econometric strategy that we follow makes eclectic use of the KPF framework, and looks at firms' propensity to introduce either a product or a process innovation, by considering among its main determinants their decisions to invest in intangibles.

The choice of the dependent variable, which in other studies with this framework is usually the firm's patent stock, is simply driven by data availability and will have to be retained in interpreting the results.[9] More precisely, it is represented by a dummy variable, *Innovation*, which takes value *1* if the firm has introduced new or significantly improved products, services

[7] The rates of response - ranging from 6% to 69% - have been, as expected, systematically lower than those achieved by official business surveys. By comparing the national rates of response, the pattern is the same as for surveys like the EU Community Innovation Survey. However, the actual rates for the Innobarometer-2013 are, on average, 50-70% lower than standard business statistics. In this last respect, it should be noted that the national data collectors stopped contacting new enterprises after getting the minimum requested number of respondents per country.

[8] In particular, a cluster analysis has been performed following the method of "non-hierarchical" clustering (k-means clustering, FASTCLUS procedure in SAS), which is highly sensitive to outliers and – when asking for the identification of a quite large number of clusters (50 clusters in this analysis) – should be able to include outliers in the smallest clusters and in those which are most distant from the nearest cluster. From this analysis, the outliers have resulted as being those observations with very high values for all the variables. Nevertheless, by comparing the average score of the whole population with and without outliers, in both cases outliers do not influence these scores more than 7-8% of the value.

[9] Unfortunately, the questionnaire of the Innobarometer-2013 does not distinguish between product and process innovations (see Q9 in Appendix B), nor does it contain questions on the firm's patenting activity.

or processes, and *0* otherwise (question Q9 in Appendix B).

As far as the input-like regressors of the KPF are concerned, we follow our theoretical approach (Section 2.2) and look at the amount of resources that firms have invested in each of the six intangibles as a percentage of their total turnover, either internally or externally. Looking at the ranges of answers of the two relative questions (i.e. Q2 and Q3 in Appendix B), we thus

consider two sets of categorical variables. That is, respectively: *Internal Training*, *Internal Software*, *Internal Reputation/Brand*, *Internal R&D*, *Internal Design*, and *Internal Organisation/Business; External Training*, *External Software*, *External Reputation/Brand*, *External R&D*, *External Design*, *External Organization/Business*.

As baseline estimation, we plug the previous intangible regressors into the KPF and estimate it with a probit model:

$$Innovation_i = \alpha_0 + \alpha_1 Internal_Intangibles_i + \alpha_2 External_Intangibles_i + \alpha_3 Controls_i + \varepsilon_i \qquad (1)$$

where *Internal Intangibles* and *External Intangibles* are the two (1x6) vectors of intangible investments, and *Controls* is a suitable vector through which we address the problem of unobserved heterogeneity in our estimates, as far as the determinants of the firms' innovation profile is concerned.

In this 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 dummies is also be inserted for the same scope.[10]

An additional reason for concern in estimating Eq.(1) is of course represented by the possible endogeneity of the regressors. The *Intangibles* vectors actually account for investment behaviours, on which the innovation propensity of the firm could in principle have a certain

[10] Although not a very detailed level of industry classification, the categories we have identified - Manufacturing (NACE Category C), Services (NACE Categories G/H/I/J/K/L/M/N/R) and Utilities (NACE Categories D/E/F)- have been imposed by the stratification needs of the sampling design. Still, we are confident that such a disaggregation accounts for most of the variance, across the sampled firms, that is not explained by the other regressors.

effect. While this problem could represent an obstacle in looking for causal rather than simple correlation relationships, as we actually do instead, its incidence could be attenuated by searching for a proper set of instruments for our main regressors: that is, of the firm's investment decisions on intangibles. In this last respect, the structure and the formulation of the questions of the Innobarometer-2013 provide us with interesting opportunities. Firstly, in the search for a first set of instruments, we looked at the business objective that the

interviewed firms have declared to follow in the initial informative section of the questionnaire. In particular, our choice pointed to the two standard Porterian alternatives of a "differentiation" and a "price" strategy. Following a strategic management perspective, we deem these objectives mainly affected by the market structure in which firms operate, and therefore somehow isolated from other endogenous factors. In particular, we claim that intangible resources are the key drivers of competitive advantage, when firms consider a "differentiation strategy" at large 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. Accordingly, it is consistent with a broad set of uniqueness factors (e.g. complementary services, marketing and advertising, quality control, and the like), integrity features of the products/services (e.g. between the products' components and the customers' preferences), and quality signals (e.g. in terms of reputation), to which the six intangibles of the Innobarometer-2013 are directly related (Grant, 2010). Conversely, intangibles 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). It should be noted that the formulation of the specific question we are considering for building up our first set of instruments, support our view about their exogeneity with respect to product or process innovation outputs. Indeed, 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). 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. On these bases, we have used as dummy-instruments the two most coherent responses that the Innobarometer-2013 firms were asked to provide to the question about their business priority (out of the five of question Q1 in Appendix B): that is, the search for tailored customised solutions (*Differentiation*) and for ensuring lower prices (*Price*).

As a second set of instruments, we have considered the firm's treatment of the intangibles at stake as actual "assets", that is: the firm's expectation of returns that extend over the period in which the expenditures have been incurred. We believe that the expected benefits declared for the intangible investments are a rather structural kind of variable with respect to the issue we address, given their dependence on accounting standards and regulation. Furthermore, given

the way in which the relative questions have been posed to the interviewed firm, and their inclusion in the questionnaire before the innovation related section, the expectations to which the respondents refer to are not necessarily correlated with the ex-ante expectations of future innovation opportunities. Furthermore, potential problems of endogeneity are reduced when, as we are going to do in the following, different groups of intangibles are considered, instead of single ones, on the basis of the regularities (components) that firms show in the relative investments.[11] While we let the relative tests to confirm its exogeneity, the second instrument that we choose is thus represented by the number of years over which the surveyed firms have declared that they expect economic benefits from them (question Q4 in Appendix B): that is, *Expected benefits*.

Making use of the previous instruments, our econometric strategy for estimating Eq.(1) consists of two steps. In the first step, we look for regularities (components) shown by the twelve intangible regressors and instrument them by resorting to the instruments identified above. In the second step, we plug the estimated values of this components in a modified Eq.(1) and estimate it accordingly. Given that, in this last equation, the firm's innovation is captured by a binary variable, we implement an instrumental variables probit estimation, which permits us to take into account the possible endogeneity of the intangible investment regressors and, in particular, to employ the efficient two-step estimator proposed by Newey (1987).

[11] For example, expected benefits from R&D could be hardly thought as independent from innovation related returns. On the other hand, by averaging the expected returns of different items, potential problems of this kind are considerably reduced.

4 Results

As a preliminary step towards our announced two-stage econometric strategy, let us first consider how a firm's probability to innovate is correlated with our two *Intangibles* vectors in Eq.(1). As Table 1 shows, with the notable exception of *Training*, individual intangible investments all show a significant and positive sign with respect to *INNO*, when their internal development is considered. Conversely, with respect to their external development, all of the individual intangibles appear not significant but *Design* and *Software*.[12]

This is a first bit of preliminary evidence that, although in the presence of possible bias due to the regressors' endogeneity, supports the relevance of the "make-or-buy" argument we have addressed in the theoretical background (Section 2). With the notable exceptions of two of the currently most outsourced intangible activities - one just needs to think of the prominent role of software and design professional providers for firms of different size and industry - their externalisation seems to imply problems in their innovation exploitation, which would not emerge internally.

A second piece of evidence comes from some punctual analysis of the individual internal regressors. Although apparently unexpected, training is the only one that does not show a significant impact on the firm's innovation propensity: a result that is however less striking when we think that the learning processes favoured by trained personnel translate more directly in other innovations (e.g. organizational) than the technological ones captured by our dependent variable.

Along the same line of reasoning, quite expected is that R&D, design and software - that is, the most technological of our intangible drivers - show, on average, higher coefficients than the others. All in all, along with their internal/external development, the nature of the intangibles in question seems to make a difference on their innovation impact, still in line with our theoretical argument (Section 2).

[12] Let us note that the impact of software does not seem to be different in the two realms: internal or external resources (a t-test on their equality has been rejected).

Table 1: Intangible investments and the probability to innovative

	Coef.	Std. Err
Intangible Investments		
INTERNAL		
R&D	0.105***	[0.013]
Design	0.096***	[0.011]
Software	0.053***	[0.013]
Training	0.004	[0.014]
Reputation/Brand	0.053***	[0.013]
Organization/Business	0.046***	[0.012]
EXTERNAL		
R&D	0.033	[0.020]
Design	0.053***	[0.017]
Software	0.046***	[0.016]
Training	-0.003	[0.016]
Reputation/Brand	0.014	[0.016]
Organization/Business	-0.001	[0.016]
Controls		
Employees		
_1_9	*Reference*	*Reference*
_10_49	0.117***	[0.033]
_50_249	0.225***	[0.042]
_250+	0.312***	[0.064]
Young (after 2007)	-0.091**	[0.042]
Group	0.160***	[0.037]
International	0.018	[0.040]
Constant	-1.076***	[0.078]
Industry dummies	*Included*	*Included*
Country Dummies	*Included*	*Included*
Observations	*9679*	
Pseudo R-squared	*0.117*	
Chi-square	*1529*	

Robust standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Beyond supporting the conceptual premises of the paper, the previous evidence also suggests a possible, more convenient, way to implement the two-step econometric strategy that we have envisaged for it (Section 3). Rather than continuing on to a cumbersome instrumentation and post-estimation of each of the twelve intangible regressors, we could search for a more systematic evidence of the theoretical hints discussed above. Accordingly, we instead implement our estimation strategy with respect to some meta-variables, derived from the variance of the twelve regressors, which could describe different dimensions of the firms' intangible investment decisions in a compact way.

In order to do that, we run a Principle Component Analysis (PCA) of our twelve focal regressors and try to adapt our two-step model accordingly. This approach also has the advantage of converting the possibly correlated variables into a set of linearly uncorrelated ones.

As Table 2 shows, the outcomes of the PCA are consistent with both our theoretical background and explorative estimates, and thus support this adaptation.[13]

Table 2: Principal Component Analysis of expenditures in intangibles - Q2 and Q3

	Component 1	Component 2	Component 3
Internal investments (Q2)			
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****
Organization/Business	0.282***	***0.343****	*-0.272****
External investments (Q3)			
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****
Organization/Business	0.306***	*-0.274****	*-0.097****
Eigenvalues	4.796	1.367	1.040

*** p<0.01

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: in short, the *Resource Intensity* of the retained intangibles.[14] 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 different kinds of intangibles. On the one hand, it is positively

[13]As generally accepted in empirical applications, we retrieve the components with an eigenvalue greater than 1: in our case, they explain about 64% of the variance of the original variables. Although PCA is not the most appropriate technique with categorical variables, the presence of as many as seven classes for each variable allows us to use it, instead of a Multiple Correspondence Analysis (MCA), in order to better illustrate the basic features of the underlying data.

[14] The flash nature of the Innobarometer survey has prevented the interviewer from distinguishing the actual nature of these resources, which should thus be meant in broad economic terms (see Q2 and Q3 in Appendix B). The reference to their incidence on the firm's turnover makes of the variable at stake an intensity kind of variable.

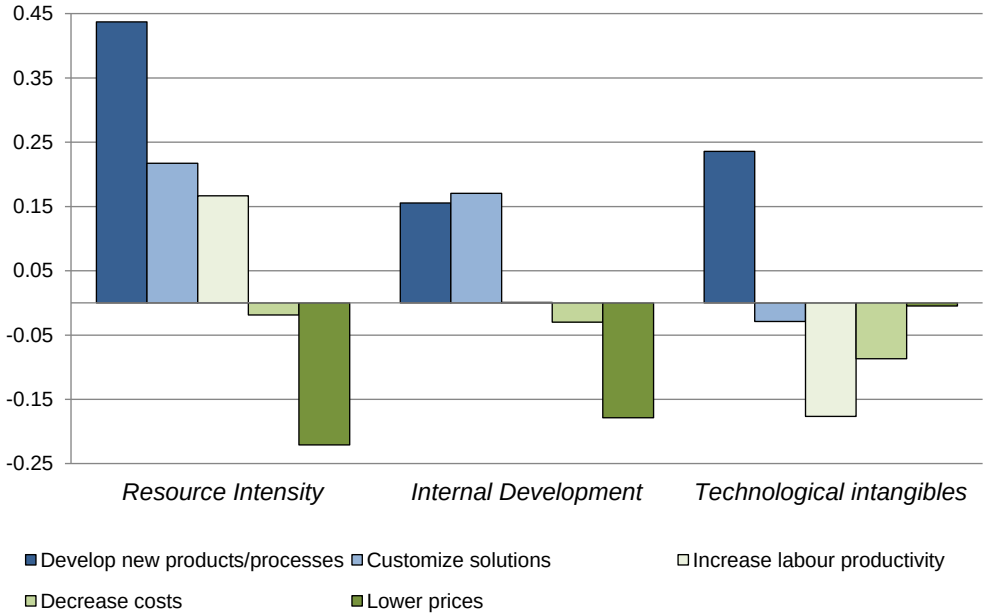
associated with investments in intangibles that can be more easily related to a consequent increase of the technological knowledge of the firm, that is software, R&D and design (see Section 2.1).[15] On the other hand, the same component is negatively correlated with intangibles that, unlike the former, "crystallize" knowledge of more organizational nature and scope, that is: training, reputation and branding, organisation and business processes. Indeed, unlike the former, these are also less easily separable from the organisation in which they are embedded, unless through the acquisition of the entire company. On the basis of this distinction, we take the third component to account for the firm's intensity of *Technological intangibles.*

As we anticipated in the previous section, the investment decisions in the six individual intangibles that the three previous components account for could hardly be considered as exogenous with respect to the firm's innovation propensity. The same can be argued with respect to the three components that we have identified. Suffice here to think of the possible reverse effect that a firm's innovation propensity could have on the intensity of resources and competencies invested in intangibles. Accordingly, their instrumentation is also recommendable. What is more, the set of instruments that we have identified in Section 3 can be deemed suitable in this context as well. Firstly, as Figure 1 reveals, the firms that have declared that they will search for a differentiation (price) advantage are those that place relatively more (less) weight on each of the three components that we have identified; Resource intensity and Internal development in particular. Accordingly, Differentiation and Price appear consistent instruments for our components.

Secondly, the overall *Expected benefits* we have referred to above could be substituted with two more disaggregated instruments, that is *Technological* and *Non-technological (intangibles') expected benefits*. Their consideration reveals itself to be useful in accounting for the possible endogeneity of the *Technological intangibles* component.

[15] While evident in the first two cases, the technological nature of the third one emerges clearly when we think of its relevance for the development of new product and for their technological architecture (Ravasi and Stigliani, 2012).

Figure 1 - Firm priorities and intangible investment intensity (weighted)



On this basis, the first step of our econometric strategy can be represented by the instrumentation of the three identified intangible components – *Resource intensity*, *Internal development*, and *Technological intangibles* – with respect to the four identified instruments – *Differentiation*, *Price*, *Technological expected benefits*, *Non-technological expected benefits*. Although the relative coefficients can at most be taken as suggesting correlations among the variables at stake, rather than as proper causal relationships, the results of this instrumentation provides us with interesting insights that deserve attention.[16] The descriptive statistics of the variables used in the analysis are reported in Appendix A (Table A.2).

4.1 The components of the firms' intangible investments

As Table 3 shows, the results on the role of the firm's business priorities identified (Figure 1) are in general mixed, but still in line with our expectations for the investment components. Pursuing a *price* strategy is not correlated with the *Resource intensity* of the firms' intangible investments, while it shows a negative (and possibly positive) correlation with their internal (external) development. In the search for a cost advantage, intangibles do not appear strategic, and keeping their development in-house also appears less crucial. Conversely, and consistently,

[16] The estimation results are reported for within sample estimations. As a robustness check, we carried out estimates using weights, which refer to the whole population of firms in the considered countries. The results are qualitatively similar. The signs and relative magnitudes of the coefficients are confirmed, (with the only exception of *Differentiation* and *Technological intangibles* in the first stage equation, for which the coefficient appears to be negative, but very close to zero). Overall, however, it should be noted that the very large number of observations (more than 38 million), for the weighted sample strongly inflates the standard errors.

pursuing a *Differentiation* strategy correlates positively with both a firm's *Resource intensity*, as well as with their *Internal development*, which thus now appears more strategic. Finally, let us notice that the kinds of intangibles that the firms invest in, at least in terms of technological content, are neutral with respect to the business priorities of the firms. The choice between a cost and a differentiation advantage, which is crucial for that of the internal or external development of intangibles, is presumably still too general to make some intangibles more strategic than others.

Looking at the expected benefits of the considered intangibles, they show theoretically consistent correlations. First of all, the longer the time-horizon along which firms expect to benefit from their intangibles, the more intense the firms' investments in them (*Resource intensity*): that is, the more they retain intangibles strategically for a competitive advantage, which is sustainable over time.

This holds true for both *Technological* and *Non-technological expected benefits*, but it appears to be stronger for the former than for the latter. This could be due to the fact that technological intangibles are also relatively more marketable and thus more controllable in market transactions, which could represent a possible guarantee to eventually recover the invested resources.

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. In this last respect, let us observe that the size of the coefficients appears reversed with respect to the previous case (i.e. *Resource intensity*). This time (i.e. in front of *Internal development*) the benefits deriving from non-technological intangibles show a larger correlation. The benefits of an extra year of economic returns are more strongly associated with a firm's internal investments in intangibles that are organisationally embedded, rather than in separable ones.

Table 3 – First step: Instrumenting intangible investments (components)

	Resource Intensity	Internal Development	Technological Intangibles
Business priority			
Price	-0.055	-0.060***	0.015
	[0.036]	*[0.024]*	*[0.017]*
Differentiation	0.057*	0.066***	0.018
	[0.034]	*[0.022]*	*[0.016]*
Expected benefits			
Technological	1.009***	0.074***	0.705***
	[0.023]	*[0.015]*	*[0.011]*
Non-technological	0.553***	0.105***	-0.560***
	[0.022]	*[0.014]*	*[0.010]*
Controls			
Employees			
_1_9	*Reference*	*Reference*	*Reference*
_10_49	0.152***	0.036	-0.087***
	[0.037]	*[0.024]*	*[0.017]*
_50_249	0.151***	-0.086***	-0.122***
	[0.047]	*[0.031]*	*[0.022]*
_250+	0.230***	-0.224***	-0.112***
	[0.070]	*[0.057]*	*[0.033]*
Young (after 2007)	0.121***	0.044	0.002
	[0.045]	*[0.030]*	*[0.021]*
Group	0.047	-0.046*	-0.035*
	[0.041]	*[0.027]*	*[0.019]*
International	0.065	-0.047*	0.104***
	[0.044]	*[0.029]*	*[0.021]*
Constant	-1.368***	-0.087***	0.095***
	[0.086]	*[0.057]*	*[0.040]*
Industry dummies	*Included*	*Included*	*Included*
Country Dummies	*Included*	*Included*	*Included*
Observations	*9679*	*9679*	*9679*
F-statistics	*139.1*	*15.3*	*109.3*
Adj R-squared	*0.462*	*0.124*	*0.402*

Robust standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

This is consistent with the resource/competence-based view of the firm, according to which it is actually harder to outsource and/or contract out the former. Theoretically and internally consistent 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. The inclusion

of the intangible investments' components that we have identified in the analysis of their innovation impact thus seems accurate.

In the same respect, additional interesting insights emerge by looking at the considered controls. Firstly, firms of different size seem to pursue different investment strategies. As their size increases, firms are found to invest more in intangibles (increasingly positive *Resource intensity*), to rely more on external providers (increasingly negative *Internal development*), and to prioritise investments in non-technological intangibles (increasingly negative *Technological intangibles*, apart from the largest ones). The first result points to the possible existence of general economies of scale in investing in intangibles. On the other hand, as the firms' scale increases, a Smithsonian labour-division with external providers in developing intangibles also makes resorting to the market progressively more convenient. Larger firms are also those whose organisational structure is more explicit (i.e. in the definition of business units and in their coordination mechanisms) and in which intangibles intensive of organizational nature have greater chances of being developed.

Our analysis of the firms' decisions to invest in intangibles does not show traces of a "liability of youngness". On the contrary, younger firms appear to attach a greater strategic value to them with highly significant results, though in terms of total resources only (*Resource intensity*): on this basis, the role of intangibles in supporting business start-ups and in enabling firms' growth over their life-cycle becomes an interesting issue to be addressed in future research.

Somehow inconsistently with previous evidence - though on the opposite causal link (e.g. Denekamp, 1995; Delgado-Gómez et al., 2004) - internationalised firms do not show higher investments in intangibles than other firms, but nor do they show lower investments *(International* is not significant with respect to *Resource intensity).* Quite interestingly, although with low significance, internationalisation could provide an advantage in outsourcing (and possibly offshoring) intangibles, this time consistently with the empirical literature on the advantages it provides in terms of knowledge of the relevant (foreign) markets (Görzig and Stephan, 2002): *Internal development* is (weakly) significant and negatively correlated with *International*. Extremely interesting is also the strong and positive correlation between *International* and *Technological intangibles*, suggesting that intangibles like R&D, software and design, could be more usable than the organizational ones for competing in the global markets.

The results that we find for firms belonging to a business group with respect to the first two components are similar to those for international ones, possibly because internationalised firms are also MNC with complex (i.e. group) ownership structures (we do not have direct information about that). However, unlike for international firms, belonging to a group appears to provide (although weakly) an advantage in investing in non-technological, rather than technological, intangibles (the third component is negatively correlated with *Group*). Once again, the more articulated levels of governance implied by business groups could provide an advantage in managing intangibles' of organisational nature.

4.2 Intangible investments and firms' propensity to innovate

Coming to the second step of the estimation (Table 4), let us first observe that a standard Wald test leads us to reject the null hypothesis of exogeneity for the intangible investment regressors. The error terms in the structural equation (probit) and the reduced-form equation for the endogenous variables (instrumented regression) are correlated and therefore instrumenting the endogenous variables appears to be the appropriate decision. Furthermore, in the presence of four instruments for three endogenous regressors, the application of the Amemiya-Lee-Newey test for an over-identifying restriction confirms the validity of the instruments employed (uncorrelated with the error term and correctly excluded from the estimated equation).

Coming to the outcomes of the relative estimation, a first striking result emerges: the innovation impact of intangibles appears mainly related to a make option by the firm (*Internal development* is significantly positive and with a larger coefficient). Increasing the size of this investment *per se* does not have the same impact (in term of magnitude) in increasing the firms' innovativeness. The intensity of the resources firms invest in intangibles (*Resource intensity*), irrespective of their origin, has a lower impact on the probability (capacity) to innovate compared to resorting to internal resources for the sake of 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. 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 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 et al., 2007). On the other hand, the combined result that we obtained on *Resource intensity* and *Internal development* also has 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).

Another important result of the second step of our econometric model is the significantly positive effect that *Technological intangibles* (that is, the resources dedicated to them) have on the firms' innovation in the way we have meant it. Indeed, our application focuses on a technological kind of innovation, represented by the introduction of new or improved products/services and business processes. It is therefore consistent to find this innovation outcome correlated with a component (our third), which synthetically accounts for the most typical of its inputs, that is R&D, and for other two key ingredients of the development of new products and processes, that is software and design.

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, that some simple descriptive statistics of the Innobarometer confirms (Montresor et al., 2014).

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 (e.g. in the form of absorptive capacity). A related argument concerns the higher organisational separability of technological intangibles, which enables firms to channel them more easily towards an innovation outcome. Their organisational mapping (at least in large companies) in correspondent divisions/departments as well as their mapping in the firms' accounting - at least

for R&D and software - makes the innovation destination of the relative investments easier: a result which, although in the unique case of large companies' R&D, is supported by a specific question (question Q10 in Appendix B) of the Innobarometer-2013.

Table 4 - Second step: The probability to innovative

	Coef.	Std. Err.
Intangible investments		
Resource intensity	0.166***	[0.062]
Internal development	1.251**	[0.482]
Technological intangibles	0.144**	[0.051]
Controls		
Employees		
_1_9	*Reference*	
_10_49	0.026	[0.045]
_50_249	0.234**	[0.080]
_250+	0.453**	[0.154]
Young (after 2007)	-0.123**	[0.057]
Group	0.200***	[0.055]
International	0.080	[0.058]
Constant	-0.674***	[0.105]
Industry dummies	*0.043***	
Country Dummies	*0.000****	
Observations	*9679*	
Chi-square	*768.09*	
Wald test	*109.06*	
Overid (pval)	*0.757*	

Robust standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

All in all, this second block of results seems to confirm that the innovation impact of intangibles is not a simple one, but rather depends on the strategic choices of the firm in their investments, in particular, in terms of internal vs. external competences/resources devoted to them, and of the technological vs. non technological nature of the targeted intangibles.

In addition to that, of course, other firm-specific elements should be considered. For example, larger firms have the lead in innovating, and the same occurs for firms belonging to business groups. Moreover, when the investment decisions of the firms are considered, as in our model, younger firms do not confirm the higher innovation dynamism that other studies have shown and rather have a lower innovative profile than older firms. Similarly, the firms'

internationalisation, which has appeared to count for its decision to invest (internally rather than externally) in intangibles, does not have a direct innovation impact. Our two steps model provides insights on the different layers of the relationship we are investigating.

5 Conclusions

Intangibles are assets whose economic impact depends on the complex decisional process through which firms invest in them. This is the starting point of the growing literature that is trying to plug intangibles in productivity growth analysis, at both macro and micro-level. Rather unfortunately, such a starting point is missed in innovation studies, in which intangibles are usually taken as given flows or stocks, whose strategic antecedents are usually neglected.

In this paper we have taken the opportunity to use a recent European survey on firms' decisions to invest in intangibles (the Innobarometer-2013) to fill this gap. In spite of its limitations, such a survey has enabled us to test a model of the impact of intangibles on innovation, in which they emerge from the firms' business strategy. Indeed, the results are supportive of this view. Intangible investments are actually consistent with the business priority a firm follows and with the expected duration of their benefits. These strategic elements thus need to be taken into account. Once this is done, the innovation impact of intangibles appears strategic too. Investing more in intangibles does not boost firms' innovativeness as much as its strategic choice to dedicate internal resources and competences to them. This of course has important strategic and policy implications. On the one hand, managers should be cautious in leaving the development of intangibles to external providers (that is, in outsourcing them). On the other hand, policy makers should consider the lack of internal competences and resources as a more serious failure to address than the difficulties firms face in accessing the market for intangibles through innovation cooperation and technology transfer: a recommendation, which is also supported by the specific question of the Innobarometer on the obstacles to investing in intangibles (question Q7 in Appendix B) (Montresor et al., 2014).

Strategic considerations also emerge with respect to the kinds of intangibles that have emerged as having an innovation impact for the firm: an aspect that the comprehensive analysis that the Innobarometer originally provides for six intangible typologies has allowed us to disentangle. The firms' innovativeness increases by increasing the resource allocation to

intangibles, whose higher technological content and degree of *separability* make an innovation outcome more functional and whose constituent knowledge is more easily applicable to new products/services and processes: that is, technological innovations. This result also has an important implication in strategic and policy terms: managers and policy makers, in their respective realms, should more directly retain that specific kind of innovation map particular sorts of intangibles and that, accordingly, there is not a one-fits-all intangible for the sake of innovation.

The previous results naturally spurs analysis of the role that intangibles have on firms' non-technological innovations (e.g. organisational and marketing innovations), an aspect on which the Innobarometer also has a specific question (question Q9 in Appendix B). Further developments can be carried out by enlarging the set of features that possibly concur to qualify the strategic position of the firm with respect to its intangibles, such as the specific motivations that, in addition to its business objective, have led it to invest in intangibles (question Q6 Appendix B).

All of these, and possibly other aspects, make of the Innobarometer-2013 an important source to deepen the analysis of intangible investments for the sake of innovation. In parallel, the limitations of the same survey should be retained. Amongst 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 distant proxy of the actual and accounted investments firms report for the same scope. 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.

Appendix A

Table A.1: Country distribution of firms (number – share)

Austria (300 - 2.65)	Lithuania (202 - 1.78)
Belgium (300 - 2.65)	Luxembourg (100 - 0.88)
Bulgaria (301 - 2.66)	Malta (100 - 0.88)
Croatia (200 - 1.77)	Norway (200 - 1.77)
Cyprus (100 - 0.88)	Poland (500 - 4.42)
Czech Republic (302 - 2.67)	Portugal (300 - 2.65)
Denmark (302 - 2.67)	Republic of Serbia (201 - 1.78)
Estonia (205 - 1.81)	Romania (501 - 4.43)
Finland (300 - 2.65)	Slovakia (300 - 2.65)
France (500 - 4.42)	Slovenia (200 - 1.77)
Germany (499 - 4.41)	Spain (500 - 4.42)
Greece (300 - 2.65)	Sweden (301 - 2.66)
Hungary (300 - 2.65)	Switzerland (200 - 1.77)
Iceland (200 - 1.77)	FYROMacedonia (200 - 1.77)
Ireland (300 - 2.65)	The Netherlands (500 - 4.42)
Italy (500 - 4.42)	The United Kingdom (500 - 4.42)
Japan (500 - 4.42)	The United States (501 - 4.43)
Latvia (202 - 1.78)	Turkey (400 - 3.53)

Table A.2: Sample Descriptives

	Percentiles					Obs.	Mean	Std.Dev.
	10%	25%	50%	75%	90%			
Intangible Investments								
Resource intensity	-2.120	-1.457	-0.442	0.951	2.515	9708	0	1.96
Internal development	-1.019	-0.551	-0.176	0.437	1.142	9708	0	0.97
Technological intangibles	-1.000	-0.424	0.143	0.499	1.011	9708	0	0.87
Expected benefits								
Technological	0.000	0.000	0.667	1.333	2.000	10875	0.89	0.88
Non-technological	0.000	0.667	1.000	2.000	2.333	10903	1.25	0.92
Business Priority								
Price (Yes/No)						10962	24.2%	
Differentiation (Yes/No)						10962	37.9%	
Controls								
Young (Yes/No)						11310	13.2%	
Group (Yes/No)						11298	23.9%	
International (Yes/No)						11317	16.8%	
Size						11317		
_1_9						4959	43.8%	
_10_49						3469	30.7%	
_50_249						2086	18.4%	
_250+						803	7.1%	

Appendix B

European Commission

Flash Eurobarometer 369

INVESTING IN INTANGIBLES: ECONOMIC ASSETS AND INNOVATION DRIVERS FOR GROWTH

Questionnaire

Socio-economic questions

Let me start with a few basic questions about your company. For all questions, please limit your responses to your company's activities IN [YOUR COUNTRY] only.

D1 **Is your company part of a group?**
(READ OUT – ONE ANSWER ONLY)

Yes	1
No	2
DK/NA	3

D2 **In which country is the head office of your group located?**
(READ OUT – WRITE THE ANSWER)
DK/NA 2

If your company is part of a group, please answer the remaining questions only for your company in (OUR COUNTRY). Do not include results for subsidiaries or parent companies outside of (OUR COUNTRY).

D3 **How many employees (full-time equivalent) does your company currently have?**
(READ OUT – ONE ANSWER ONLY)

1 – 9	1
10 - 49	2
50 - 249	3
250 or more	4
DK/NA	5

IF D3=5 THEN STOP INTERVIEW

D4 **When was your company established?**
(READ OUT – ONE ANSWER ONLY)

Before 1 January 2007	1
Between 1 January 2007 and 1 January 2012	2
After 1 January 2012	3
DK/NA	4

D5 **What was the turnover of your company in 2011?**
(WRITE DOWN THE ANSWER and RECORD THE INFORMATION – IF "DK/NA" CODE 9)

__ __ __ __ __ __ __ __ __ __ __ __
Refuse/DK/NA 9

Less than 100 000 euros	1
From 100 000 to 500 000 euros	2
More than 500 000 to 2 million euro	3
More than 2 to 10 million euro	4
More than 10 to 50 million euro	5
More than 50 million euro	6
DK/NA	8

IF D5=9 'DK' THEN STOP INTERVIEW

D6 **Compared to 2010, did your company's turnover in 2011…?**
(READ OUT – ONE ANSWER ONLY)

Rise by more than 25%	1
Rise by 5 – 25%	2
Remain approximately the same	3
Fall by 5 – 25%	4
Fall by over 25%	5
DK/NA	9

D7 **Has your company been taken over, merged with another company or sold off any part of the business since 1 January 2011?**
(READ OUT – MULTIPLE ANSWERS POSSIBLE)

The company has been taken over or has merged with another company	1
The company has sold off a part of the business	2
Neither of these	3
DK/NA	9

D8 Approximately what percentage of your company's turnover in 2011 came from sales in each of the following markets?
(READ OUT - WRITE THE ANSWERS IN PERCENTAGES)

Locally, in the area or region where your company is located	%
In your own country outside the area or region where your company is located	%
In other EU countries, or in Switzerland, Norway, Iceland, Liechtenstein	%
In other countries outside the EU	%
DK/NA	999

Section: Investment in intangible assets

Q1 Thinking about the priorities for your company, please tell me which two of the following are the most important?
(ROTATE - READ OUT –MAX 2 ANSWERS POSSIBLE)

Rapid development of new products or services	1
Tailored, customised solutions	2
Ensuring lower prices	3
Increasing labour productivity	4
Decreasing the production costs	5
Other (SPONTANEOUS)	6
DK/NA	7

Q2 In 2011, what percentage of its total turnover did your company invest in the following activities using internal resources (i.e. relying solely on internal resources and capacities)?

	0%	Less than 1%	1 - 5 %	5-15%	15-25%	25-50%	More than 50%	DK
Training	1	2	3	4	5	6	7	8
Software development, excluding research and development (R&D) and web design	1	2	3	4	5	6	7	8
Company reputation and branding	1	2	3	4	5	6	7	8
Research and development (R&D)	1	2	3	4	5	6	7	8
Design of products and services (excluding research and development (R&D))	1	2	3	4	5	6	7	8
Organization or business process improvements	1	2	3	4	5	6	7	8

Q3 In 2011, what percentage of its total turnover did your company invest in the following activities using an external provider for which the company paid (i.e. relying solely on external resources and capacities)?

	0%	Less than 1%	1 - 5 %	5-15%	15-25%	25-50%	More than 50%	DK
Training	1	2	3	4	5	6	7	8
Software development, excluding research and development (R&D) and web design	1	2	3	4	5	6	7	8
Company reputation and branding	1	2	3	4	5	6	7	8
Research and development (R&D)	1	2	3	4	5	6	7	8
Design of products and services (excluding research and development (R&D))	1	2	3	4	5	6	7	8
Organization or business process improvements	1	2	3	4	5	6	7	8

Q4 **On average, for how long does your company expect to benefit from its investments in the following activities?**
(ONE ANSWER PER LINE)

	READ OUT - ROTATE	Less than 2 years	2-5 years	6-10 years	More than 10 years	DK
1	Training	1	2	3	4	5
2	Software development, excluding research and development (R&D) and web design	1	2	3	4	5
3	Company reputation and branding	1	2	3	4	5
4	Research and development (R&D)	1	2	3	4	5
5	Design of products and services (excluding research and development (R&D))	1	2	3	4	5
6	Organization or business process improvements	1	2	3	4	5

Q5 **Have the following investments been reported as "intangible assets" in your company's 2011 balance sheet?**
(READ OUT – ONE ANSWER ONLY)
(ONE ANSWER PER LINE)

	READ OUT - ROTATE	Yes	No	Not applicable (SPONTANEOUS)	DK
1	Research and development (R&D)	1	2	3	4
2	Software development	1	2	3	4
3	Other (training, design, reputation and branding, organization or business process improvements)	1	2	3	4

Section: Reasons for investing in intangible assets

Q6 **Did any of the following motivate you to invest in the intangible assets mentioned previously?**
(ROTATE - READ OUT – MULTIPLE ANSWERS POSSIBLE)

Improvement of internal skills on the intangible assets	1
More rapid development of new company services or products	2
Better economic returns or larger market shares	3
Better relationships with customers and business partners	4
Greater efficiency of internal business process	5
Public financial support (grants, loans and support for recruiting new staff etc.) for intangible assets	6
Regulatory framework of your industry (environmental regulations, technical standards)	7
DK/NA	8

Q7 **Did any of the following, if any, discourage you from investing in the intangible assets mentioned previously?**
(ROTATE - READ OUT – MULTIPLE ANSWERS POSSIBLE)

Accounting rules for reporting capital expenditure are difficult to understand	1
High costs of the investment	2
Limited external sources of information or expertise	3
Unfavourable tax treatment of intangible assets	4
Limited public financial support (grants, loans, support for recruiting new staff etc.) for intangible assets	5
Regulatory framework of your industry is difficult to understand (environmental regulations, technical standards)	6
DK/NA	7

Section: impact of investments in intangible assets

Q8 **Has the previous investment in intangible assets benefited your company in terms of?**
(ONE ANSWER PER LINE)

		A lot	Some	Little	None	DK/NA
1	Sales	1	2	3	4	5
2	Profit margin	1	2	3	4	5
3	Skills and qualifications of employees	1	2	3	4	5
4	Market share	1	2	3	4	5
5	Overall value of the company	1	2	3	4	5

Q9 **Between 2009 and 2011, did your company introduce any innovations, such as …?**

	Yes	No	DK/NA
New or significantly improved products, services or processes	1	2	3
New or significantly improved marketing strategies and distribution methods	1	2	3
New or significantly improved organisational structures and management methods	1	2	3

Q10 **On average what proportion of the investments you made between 2009 and 2011 in each of the following intangible assets related to innovation projects?**
(READ OUT - WRITE THE ANSWERS IN PERCENTAGES)
(INT: IF RESPONDENTS ASKS WHAT ARE INNOVATION PROJECTS: '**A project whose expected outcome is a new or significantly improved product, service, process, marketing strategy or distribution, organizational or management method'**)

READ OUT - ROTATE	0%	Less than 1%	1 - 5 %	5-15%	15-25%	25-50%	More than 50%	DK
Training	1	2	3	4	5	6	7	8
Software development excluding research and development (R&D) and web design	1	2	3	4	5	6	7	8
Company reputation and branding	1	2	3	4	5	6	7	8
Research and development (R&D)	1	2	3	4	5	6	7	8
Design of products and services (excluding research and development (R&D))	1	2	3	4	5	6	7	8
Organization or business process improvements	1	2	3	4	5	6	7	8

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Abstract

This paper investigates the innovation impact of intangibles by considering the decision of firms to invest in a comprehensive set of them. By using a new survey on a large sample of firms in 28 EU (plus 8 non-EU) countries, we first identify the principal components of the resources firms invest in six kinds of intangibles. Their contribution to the firms' propensity to introduce new products and/or processes is then estimated with a two-step model, which addresses the endogeneity of the focal regressors through theoretically consistent instruments. A firm's innovativeness depends on its choice of using internal vs. external resources for its intangible investments more than on their actual amount, and on the kind of assets these investments are directed to. Intangibles need to be managed strategically in order to have an innovation impact and the policy support of this type of investment must take this strategic use into account.

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