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August 2015

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ABSTRACT

Skill Gaps in the Workplace: Measurement, Determinants and Impacts

Optimal training decisions require employers to have accurate information about their workers' training needs. However, little is known with regard to the key factors determining the accurate transmission of worker training requirements. Using one of the few linked employer-employee surveys in the world, the 2006 Irish National Employment Survey, this paper identifies the key factors determining the correct identification of skill gaps within firms. The impact of skill gaps on average training expenditures and labour costs is also measured. The research finds that both HRM and collective bargaining arrangements are important factors in facilitating the accurate identification of skill gaps within firms. The analysis confirms that skill gaps are a key determinant of training expenditures and tend to raise average labour costs. Finally, the evidence suggests that employee perceptions of skill gaps may be prone to higher levels of subjective bias relative to those based on the employers' views.

JEL Classification: J20, J24, J50

Keywords: skill gaps, subjective bias, labour costs, training costs

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1 Introduction

There is now a considerable literature on the issue of skill mismatches (see CEDEFOP 2010 for a summary) with the majority of studies demonstrating that an inadequate alignment between the human capital of workers and firm-level requirements is costly on a number of fronts, including workers' earnings, job satisfaction, job turnover, training participation and productivity (McGuinness, 2006, Verhaerst & Omey, 2006, McGuinness & Wooden, 2010, Kampelmann & Rycx, 2012, Mavromaras et al, 2013). However, to date, the mismatch literature has focused almost exclusively on the impacts of overeducation and overskilling at the individual level, and has largely ignored the impacts of skill gaps at the firm level. Moreover, the mismatch literature has focused on the costs associated with surplus levels of education and skills, which are likely to be of less significance for firms than deficits in worker's human capital.

Skill gaps describe the phenomenon whereby the skill levels of workers are insufficient to meet the requirements of their current job. The lack of research in this area is particularly surprising given that skill gaps represent a primary motivating factor in the training investment decisions of both firms and workers. Skill gaps have the potential to harm firm-level productivity as average worker productivity is likely to be lower in the presence of substantial skill gaps; skill gaps will also tend to inflate average labour costs as organisations require more workers per unit of output. Finally, firm-level profitability will be adversely impacted by skill gaps as a consequence of the additional training and recruitment investments that arise as a direct consequence of skill gaps.

The paper seeks to address the current gaps in the literature and has two central aims:

(1) To assess the determinants and relationship between skill gaps measured from the perspective of both employers and employees in order to draw conclusions regarding the main drivers of the accurate recognition of training requirements within firms. If there are channels or institutions facilitating the

communication of those skill deficits between management, on the one hand, and workers or their representatives, on the other hand, these skill gaps should be more easily recognised, diagnosed and tackled than in firms where these mechanisms do not exist.

(2) To determine the degree to which skill gaps affect training expenditures and firm-level performance.

The paper is structured as follows: section 2 reviews the literature, section 3 describes the data and methods used in the study, section 4 outlines the central results arising from the analysis and section 5 provides conclusions and policy recommendations.

2 Review of the literature

Skill mismatch is defined as the excess or deficit of qualifications or skills possessed by individuals, relative to the skills required by the job they hold (CEDEFOP, 2012). The literature has tended to focus on the effects of overskilling and overeducation at the worker's level (Duncan and Hoffman, 1981; Allen and van de Velden, 2001). But relatively little is known about the impacts of underskilling or undereducation on individual outcome variables such as job satisfaction and earnings, and even less is known about their aggregate effect on firm-level performance.

A limited number of studies do address the issue of skill gaps on firm-level performance. Using data from the UK national employment survey (2003), Tether et al (2005) reported that over one fifth of sampled firms believed that skill gaps delayed the introduction of new products, with a third also stating that such gaps represented a barrier to introducing new work practices, A series of Northern Ireland sectoral studies (NIERC,2000; 2001; 2002; Erini, 2005), also reported descriptive evidence that skill gaps substantially hampered firm level performance due to subsequent lower productivity, a failure to meet deadlines and lower product quality. Finally, Forth & Mason (2004) report that ICT skill gaps negatively impacted company sales performance within a sample of UK firms employing ICT

professionals. Nevertheless, given the potential importance of skill gaps for both firm-level performance and training decisions, this research is surprisingly limited and largely descriptive.

Not much effort has been made in quantifying the importance of the phenomenon or identifying its determinants at the firm level, although some research has demonstrated the importance of the sector or the product market strategy of the company. Thus, a recent report of the UK Commission for Employment and Skills found that "high-end product strategy establishments are, on average, more likely than other establishments to report both skill-shortage vacancies and skills updating needs" (UKCES, 2011: 42). In the same line, Haskel and Martin (2011) holds that technical progress may create persistent skill shortages. Firms that tend to innovate, or are part of a sector in a rapid process of technological change, are thus more likely to report skill gaps.

It is important to distinguish skill gaps, which originate within firms, from those that are a consequence of skill-shortages that originate *before* hiring takes place. One focus of attention, in this respect, is the hard-to-fill vacancies and their effect on company performance (Bennet and McGuinness, 2009; Fabling and Maré, 2013). Skill gaps, though, may not be only the result of "external skill shortages", whereby firms are forced into hiring inferior candidates, but also a process that can be worsened or improved *within* the firm. Quite interestingly, in a recent exploration of skill gaps among a sample of U.S. manufacturing establishments, Weaver and Osterman found that skill gaps are not "the mechanical result of under-trained workers who simply cannot meet the skill demands of modern industry" (Weaver and Osterman: 2013). Not all their establishments with naturally higher skill demands (as high-tech plans) showed hiring problems. They interpreted this result as a sign that other factors, rather than a simple skill shortage in the external labour market, are behind skill gaps at the establishment level. They pointed to "firm strategy and a range of institutional policies that go beyond calls for workers to increase educational attainment".

In this research, we will explore precisely this possibility, the possibility that skills gaps are rooted at the firm-level; more specifically, we will look at the role of communication at the firm-level in reducing the skill gaps reported by employees and/or employers. Information channels are likely to play an important role in the training decision (Acemoglu & Pischke, 1998). Acemoglu and Pischke developed a model under which superior information held by employers regarding its employees abilities relative to other firms, encourages the firm to train even in the area of general skills. If there are channels or institutions facilitating those skill deficits at the firm level to be communicated between management, on the one hand, and workers and their representatives, on the other hand, these skill gaps should be more easily recognised, diagnosed and tackled than in firms where these mechanisms do not exist. It is only through mutual recognition of skill gaps that employer training will be initiated and gratefully received, so that productivity is increased. If skill gaps are only recognised by workers, no employer training is likely to take place and potential productivity gaps are likely to remain. Conversely, if skill gaps are only recognised by employer, workers may not be willing to participate in any training process, as they do not believe they are necessary to improve their productivity.

The importance of communication for skill gaps at the firm level will be analysed by including in our analysis factors related to human resources management, the existence of institutions of workers' representation at the firm level, and the importance of different levels of collective bargaining, which arguably may be more or less efficient in facilitating the communication of the skill needs between workers' representatives and employers**.**

As regards the level at which collective bargaining takes place, some of the most efficient national systems of skill formation are characterised by strong social agents (employers' associations and trade unions) that bargain at the sector level over the skill requirements of the workforce, thus preventing companies within the same sector from free-riding on each other by poaching each others' employees and enabling the generation of sector-specific skills, which should be regarded as a public good for the firms and their employees that would not be tenable otherwise

(Estevez-Abe, 2000; Culpepper, 1999; Thelen, 2004). Moreover, as Thelen (2004) argues, frequent coordination between social agents at the sector level guarantees a more accurate diagnosis of the skill needs and the necessary, often update of these sector-specific skill requirements. In sum, sector-level bargaining is possibly far more efficient than other levels of collective bargaining coordination for identifying skill needs of companies and promoting on-the-job training suitable to meet these needs or requirements. If this were the case, skill gaps would be lower in companies affected by sector level bargaining.

Hypothesis 1A: Skill gaps will be lower at firms covered by sector-level collective bargaining than at firms covered by collective bargaining at either firm- or national-level

As regards HRM, high performance work systems have entailed the introduction of mechanisms like 'training needs analysis', aimed at establishing "where training is needed, what needs to be taught, and who needs to be trained" (Salas and Cannon-Bowers, 2001). Like 'training needs analysis', a number of developments in HRM facilitate the assessment of the skill needs among the workforce, and therefore the skill gaps among them. Teamwork is another case: team leaders are expected to be channels of communication of skill needs between line workers and management; they keep management updated about the training needs of the latter (Smith-Jentchs et al, 2001). In sum, it is reasonable to assume that a more developed HRM structure is a top-down way of gathering information about skill gaps, and eventually correcting them

Hypothesis 1B: Skill gaps will be lower at firms with a more developed HRM structure

In terms of trade unions, their corrective effect on skill gaps may be twofold. On the one hand, workplace unionisation may be associated to longer tenure. This may in turn make employers more interested in correcting any skill gap among their workforces. Since these workforces are constituted by employees who are more difficult to lay off, employers have stronger incentives to improve their work

productivity by reducing the skill gaps among them. On the other hand, trade unions or workers' representatives may work as bottom-up ways of providing management with information about those skill gaps. Schömann provides a detailed description of how workers' representatives help identifying skill gaps in different European countries (Schömann, 2002: 188-191)

Hypothesis 1C: Skill gaps will be lower in unionised workplaces than in non-unionised ones.

Before assessing the importance eventually played by management-workers communication, relative to other determinants of skill gaps at the firm level, it is necessary to know where to look at in order measure these gaps properly. Such gaps can be identified either by workers or by employers, or by both. It is unclear to what extent worker's and employer's perceptions of skill gaps are correlated. There are considerable grounds to believe that the level of correlation may not be as great as might be imagined; that is, there are reasons why employers or employees could report skill gaps not recognised by the other part. Employers may report skill gaps in isolation if (a) employees overestimate their own competency levels (b) employers under-estimate the competency levels of their workforce, or (c) employees fail to recognise instances where their skill deficiencies have important implications for productivity. Conversely, employees may report skill gaps in isolation if (a) the skill gap is genuine but has few implications for productivity (that is, if it is of little concern to the firm); (b) the firm lacks the prerequisite communication and HRM structures that allow workers to communicate their training needs to their employer (c) employers put too much faith in formal education systems and assume that gaps are less likely the higher the workforce share of educated labour (d) employee responses reflect future career aspirations more than current job requirements.

Besides digging into the determinants of skill gaps at firm level, our research will thus contribute to the literature by exploring the analytical power of different possible indicators of skill gaps. In order to do that, we will assess the extent to which different indicators are able to explain cross-firm differences in labour and

training costs. In accordance to it, we also hypothesize that skill gaps will be associated with higher labour and training costs.

Hypothesis 2: Skill gaps will be associated with higher labour and training costs

2 Data and methods

For the study, we have used the 2006 National Employment Survey (NES), an [employer-employee matched] workplace survey carried out by the Irish Central Statistics Office. The NES covers both the public and private sectors[1]. The data covers the very height of the Irish economic boom, during which time unemployment was low and labour market conditions tight. We would reasonably expect the impacts of skill gaps to be at their height during 2006, as the rapid pace of growth and the relative scarcity of available skilled labour would have made it more difficult to eliminate skill gaps through external recruitment. The employer sample was drawn from the CSO's Central Business Register. Selected firms were asked to extract a systematic sample of employees from their payrolls. Approximately 6,500 private sector employers and 300 public sector bodies were surveyed across the economy[2]. Within this, a total sample of 60,000 employees was included from the private sector and 29,000 from the public sector.

The employer questionnaire requested information on employee earnings, hours worked and occupation[3]. Information was also obtained on firm size, sector, the use of pay agreements, HRM procedures, etc. Employees were issued with a separate questionnaire within which they provided information on their age, gender, educational attainment, employment status (part-time or full-time), length of time in

[1] While the NES was of enterprises with 3 plus employees, the results were calibrated to the Quarterly National Household Survey (QNHS) employment data for employees (excluding agriculture, forestry and fishing), which covers all employees.
[2] Only employers with more than three employees were surveyed and the data were collected at the enterprise level.
[3] The earnings information collected in the 2003 NES represents the gross monthly amount payable by the organisation to its employees, and relates to the month of March in 2003. This includes normal wages, salaries and overtime; taxable allowances, regular bonuses and commissions; and holiday or sick pay for the period in question. It does not include employer's Pay Related Social Insurance (PRSI), redundancy payments and back pay.

paid employment, length of service with current employer and also other job-related characteristics (for example, trade union membership, shift-work etc). Both employers and employees were asked similar questions regarding the existence of skill gaps. Employers were asked to indicate the competency areas where they believed that employees had gaps in their skill, while employees were asked to indicate if, for their current job, they required training in any competency area. Data was collected on both employer and employee skill gaps in the following 15 competency areas: communication skills, customer services skills, general IT skills, professional IT skills, language skills (English and foreign), literacy skills, numeracy skills, management skills, technical & practical skills and other skills.

In this study, we work under the assumption that skill gaps have been correctly identified within a firm when they have been simultaneously reported by both employers and workers. Given that our objective is to assess the degree of alignment on perceptions of skill gaps within organisations and to measure the impacts of gaps of measures on firm-level performance, we reduce our linked employer-employee data to the level of the firm by retaining one observation per organisation. We retain information from the employer survey and derived variables for each organisation based on average employee responses. We apply establishment-level weights to our firm-level observations in order to ensure that our data is representative of the population of firms in Ireland during 2006. Our sample is restricted to private sector organisations on the grounds that expenditures on training and labour costs within public sector organisations are less likely to be sensitive to market forces. After excluding missing data we retain an effective sample of 4035 private sector companies firms.

Moving onto the econometric analysis, our specifications are based on the assumption that our key outcome variables at the level of the firm will be driven by a combination of the human capital characteristics of the workforce and a range of organisational attributes. Given this, we estimate the following equations:

$$Agree = \alpha + \beta_1 \bar{H} + \beta_2 F_i + \varepsilon \qquad (1)$$

$$\overline{Tc} = \alpha + \beta_1 \bar{H} + \beta_2 F + \beta_3 Gapi + \lambda gapi + \varepsilon \quad (2)$$

$$\bar{Y} = \alpha + \beta_1 \bar{H} + \beta_2 F + \beta_3 gap_i + \lambda gap_i + \varepsilon \qquad (3)$$

Agree is a binary variable indicating that both employers and employees believe that a skill gap exists and, as such, can be considered as a situation whereby training requirements have been accurately communicated to management. *Agree* takes the value of one if employers indicate that a skill gap exists ***and*** 20 per cent of employees within the organisation also report a need for training in that particular area. While the 20 per cent cut off point is somewhat arbitrary, we argue that it represents a level of deficiency that is sufficiently high so as to represent a concern for employers[4]. $\bar{H}$ denotes the mean human capital characteristics of the workforce which are derived from average employee responses, *F* relates to firm level characteristics taken from the employer component of the sample and ε is the error term. Among these firm-level characteristics, we include our key independent variables: mode of wage bargaining, HRM variables related to the proportion of staff subject to an annual performance review or in receipt of a job description, and trade union representation. Firm level controls included in the model relate to firm-size and sector. The human capital related variables are derived on the basis of average worker characteristics and include the proportion of workers with varying levels of education, the shares of migrants, shift workers and workers belonging to professional bodies, the level of trade union density, the average level of labour market experience among the workforce and the proportion of workers who were consulted by management on matters relating to organisational change.

With respect to equations 2 and 3, $\overline{Tc}$ represents average training costs and $\bar{Y}$ average labour costs, Gap is a binary variable indicating that a skill gap exists, while λgap denotes a Heckman selection term (Heckman (1974) that accounts for the possibility that the incidence of skill gaps is non-random with respect to average

[4] This is particularly the case as the NES sample is skewed towards larger firms.

training and / or labour costs. Average labour costs are derived on the basis of the average gross monthly salary paid to responding employees within the firm, while average training costs are calculated by dividing total annual expenditures on training (course fees, travel and subsistence, costs of premises) by the number of employees in company sponsored training programmes during the year.

3 Results

Congruence or agreement between employers' and employees' perception of skill gap: Skill gaps correctly identified

Tables 1 and 2 show the percentages of firms reporting skill gaps based on the perceptions of both employers (Table 1) and employees (Table 2). An employer based skill gap is based on the firm indicating that one exists, while an employee based skill gap is recorded if more than 20 per cent of employees report a deficiency in a particular skill dimension. The percentage of firms reporting employee based skill gaps is systematically higher than the percentage reporting employer based skill gaps. The areas were skill gaps are more highly reported under both indicators are IT and communication and, to a lesser extent, technology and management. There is some correspondence between employers' and employees' perceptions in this respect, but the correlation between the two measures is relatively low: when skill gaps in any particular competency area are identified on the basis of employee perceptions, employers will typically also report the skill gap in less than 40 per cent of cases. However, when a skill gap is identified on the basis of employer perceptions, in 4 out of 6 competency areas, employee based skill gaps were also reported in more than 50 per cent of firms. Thus, it is far more common that employees also recognised gaps when employers did so than vice versa. For both measurement approaches, the level of agreement seems somewhat higher for IT, management or communication.

<Insert Table 1 here>

<Insert Table 2 here>

In order to gain further insights into the factors that influence agreement between employers and workers on training requirements, Table 3 presents the results from a multinomial logit model comparing the characteristics of organisations where both parties agree on skill gaps (skill gaps agreement) i.e. where training requirements have been correctly identified. Given that there exist a number of mutually exclusive skill gap states (j=1,2,3,4) where 1 refers no skill gaps reported by either party, 2 refers to skill gaps reported by both employees and employers (skill gaps agreement), 3 refers to skill gaps reported by employees only and 4 refers to skill gaps reported by employers alone, we estimate out models using the following standard multinomial logit approach :

$$\Pr(y_i = j)\frac{e^{\beta x_{ij}}}{\sum_{k=1}^{j} e^{\beta^j x_{ik}}} \qquad \text{j=1,.....,j}$$

We estimate the model separately for each skill dimension (e.g. a skill gap in any area, a skill gap in technology, a skill gap in IT, etc) with the reference in the dependent variable being ‘no gap being reported by either firms or employees in the specific competency area’. When presenting the results, we gather all the estimates related from the competency specific mutinomial logits and present them in a single table. For the sake of brevity, we do not report the coefficients for the sector controls; however, full results are available from the authors on request. The results for skill gap agreement are reported in table 3 and a number of patterns arise. Firstly, relative to firms reporting no skill gaps of any description, the mutual identification of skill gaps is, on the whole, more common in firms with higher shares of educated and professional workers, in larger firms, those implementing shift work practices and / operating collective bargaining mechanisms such as the National Wage Agreement and industry level agreements. HRM practices also appear to be an important factor in facilitating the mutual recognition of skill gaps among employers and workers, with significant effects evident for both performance reviews and change consultation. This comes as a confirmation of hypothesis 1B. The provision of job descriptions is also important but to a

somewhat lesser degree. With respect to industrial sector[5], relative to the Other Services base case, agreement was consistently less likely in the Transport / storage, Wholesale / retail and Public administration sectors[6]

<Insert Table 3 here>

We next identify the characteristics of organisations where skill gaps are not mutually recognised i.e. where employees or employees report skill deficiencies in isolation. As states, this represents an inefficient state that will potentially lead to under-investment in training on behalf of the firm. Table 4 analyses the determinants of firms where only employees report skill gaps relative to the base case of firms where there is agreement between employees and employers[7]. A number of common themes become apparent; employees alone are more likely to perceive skill gaps in smaller firms, those employing higher proportions of migrant workers[8], firms not implementing HRM practices, such as performance reviews or the provision of job descriptions, firms with lower levels of trade-union density and those not implement formal collective wage bargaining arrangements such as the national wage agreement[9]. The human capital characteristics of the workforce are

[5] Results are available upon request.

[6] As the data excludes public bodies, semi-state organisations are still present in the data and will be present within the Public Administration sector.

[7] Here we again estimate a series of multinomial logits for each skill area but exclude firms reporting no skill gaps and estimate relative to the base case of mutual skill gaps in the respective dimension.

[8] Migrant workers in Ireland are more likely to be educated to post-secondary level relative to natives, however, they are also more likely to be employed in elementary occupations despite having relatively more schooling. This finding is consistent with the general finding within the literature that migrant workers have a higher exposure to overeducation (Lindley, 2009; Kucel and Byrne, 2008; Dex and Lindley, 2007; Battu and Sloane, 2004; Alpin et al., 1998;)

[9] Between 1987 and 2008, wage bargaining in Ireland was largely centralised at the national level, through a process known as *Social Partnership* that facilitated a number of national wage agreements. This partnership approach, which, involved voluntary negotiations between the Government, main employer bodies and trade unions, was introduced by the Government at this time to assist it in moving the country out of the bleak economic situation that it found itself in; a period characterised by high inflation, weak economic growth and, subsequently, considerable unemployment, mass emigration and unsustainable government borrowing and national debt. There have been nine agreements to-date3which has been tailored to medium term national economic and social needs, and has often built on its predecessor. Initially, pay and wage issues were the core elements of the negotiated agreements; specifically moderate wage increases in exchange for reductions in income tax to boost take-home pay. However, as the country recovered and moved into the 'Celtic Tiger' era, the partnership nature of the agreements became deeper and their coverage was extended to include various social and welfare issues that either emerged or become more prominent as the economy prospered. Social partnership effectively ended with the onset of

also found to play a role in explaining employee based asymmetries, but the observed patterns are less consistent. Employee's specific skill gaps in the areas of languages and communication are more common in firms with a higher average level of worker experience. Employees in firms employing higher proportions of educated labour are more likely to unilaterally report skill gaps in technology and numeracy / literacy; conversely, workers in firms with lower shares of educated labour are more likely to unilaterally report skill gaps in IT. The results for literacy and numeracy may seem somewhat counter-intuitive; however, evidence from employer surveys find that literacy and numeracy problems tend to be reported, at a declining incidence, among workers of all levels of education, suggesting that responses to the question are likely to be benchmarked against job requirements as opposed to ability levels in basic literacy and numeracy. Finally, some sectoral influences were apparent with technology and management related skill gaps more likely to be reported by employees only in the Transport sector while communication gaps were more common in the Retail sector.

<Insert Table 4 here>

Table 5 compares the characteristics of firms unilaterally reporting employer skill gaps relative again to the base case where both employers and workers agree that a skill deficit exists. Again, this is likely to represent an inefficient scenario as the impact on training is likely to be lower if administered to workers who (a) do not require it or (b) require it but do not recognise the nature or impact of their own skill deficiencies. We see that asymmetries across most skill dimensions are again more common within smaller organisations and those employing higher proportions of migrants. HRM related variables are also important, but in a somewhat different form than in the model explaining employee only gaps. Employer only skill gaps are more common in organisations that do not have formal methods of consulting their workers on organisational change. The lack of job descriptions is important in the areas of IT and management, while the absence of performance reviews tend to

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the economic downturn in 2009 when the Irish Government imposed a series of pay cuts on public sector workers without the agreement of the social partners.

increase the incidence of asymmetries in the areas of technology and literacy / numeracy. Employers within firms with higher proportions of educated labour are less likely to unilaterally report skill gaps in the areas of technology, IT and management, suggesting that information asymmetries in these skill dimensions are more common within low-skilled organisations. A possible explanation to the observed pattern is that skill deficiencies are less obvious to employees in low-skilled jobs due to the relatively unsophisticated nature of the products or services they produce. Regarding sector[10], skill gaps unilaterally perceived by employers were common across most skill dimensions in the Transport / storages sector; IT management and communication asymmetries were more common in the wholesale / retail sector. Finally, employers in the Financial intermediation and Business services sector were more likely to unilaterally report skill gaps in technology.

<Insert Table 5 here>

Therefore, to conclude, a general finding arising from our research is the importance of collective bargaining, HRM practices and firm size in promoting the mutual recognition of or, alternatively, an absence of such attributes contributing to information asymmetries which may, in turn, lead to sub-optimal training investments. Collective bargaining appears to be a particularly important factor in communicating employee skill deficiencies and, therefore, fostering agreement on the training requirements of workers. Collective bargaining represents an obvious opportunity to discuss skill gaps between management and workers' representatives. Bargaining at the company level could have been expected to be the most suitable level for generating skill gaps agreement. Contrary to that, our results point to the industry or sector-level bargaining as the most suitable scenarios. This result fits with the importance of industry level bargaining in skill formation shown in other research. Strong social agents (employers' associations and trade unions) are well-known to be decisive in establishing and renewing vocational training in dual systems of vocational training, like Germany (Estevez-Abe, 2000; Culpepper, 1999). It is quite possible that collective bargaining at this

[10] Results are available upon request from the authors.

level is also better than either the company level or the national level for diagnosing skill gaps and generating a common understanding about them. The role of national level wage bargaining is somewhat less clear; as it is not immediately apparent how such centralised wage negotiations might be conducive to agreement on training requirements. It is possible that those firms implementing the national wage agreement routinely implement other forms of consultation, not observed within our dataset, to compensate for the absence of a firm-level discussion forum and that the national wage agreement variable is proxying such an unobserved effect[11].

It is notable that the measure of trade-union density is relatively unimportant in all of the models, indicating that having a higher level of trade-union members within a firm is not a guarantee that there will be a high level of contact between unions and management on employment conditions and training. This is likely to be particularly relevant in the Irish context where industry and national level agreements on pay are much more common than business level agreements whereby the unions negotiate directly with the employer on behalf of workers (McGuinness et al, 2010). More centralised bargaining structures will tend to lessen the frequency of contact between unions and management, or indeed between unions and their members, thus lowering their potential effectiveness as a communication channel for the training needs of staff.

Unlike collective bargaining, HRM is a unilateral managerial effort to investigate the skill gaps among the workforce. It is reasonable to think that companies who conduct performance reviews among the workforce, where job description are more extended, and where there is consultation on organisational change are also companies where information on skill gaps as perceived by employees arrives more easily to management, thus facilitating skill gaps agreement between employers and employees. In a recent report on skill mismatch in UK and Europe, Bevan and

[11] Within our data, individual-level agreements constitute the dominant wage bargaining mechanism in the private sector with, on average, 49 per cent of employees within the typical firm covered by such agreements. The average coverage level of the NWA was 30 percent, while industry and business-level agreements each had an average coverage level of less than 10 per cent.

Cowling provided evidence of how mechanisms established to set performance objectives and employee performance evaluation were used to detect skill gaps in one retail and one publishing company (Bevan and Cowling, 2007). Generally, the marginal effects for HRM variables are larger than those related to collective bargaining, suggesting that HRM arrangements may be somewhat more important than bargaining institutions when it comes to the successful identification of skill gaps.

The consistent firm size effect is likely to reflect the more formalised management and quality control structures that tend to be more heavily present within larger firms, which, in turn, facilitate more routine monitoring of employee performance and the detection of skill gaps. Finally, the generally inverse relationship between the share of educated workers and the prevalence of unilateral skill gaps could also be related to the structure of communication channels between management and the company. Highly-skilled workers (college graduates) are likely to occupy positions *closer* to the hierarchy. Everything else being equal, it is thus to be expected that a common understanding about the skill gaps affecting them is more likely to arise between workers and the company.

The relative impacts of skill gaps on firm-level performance

While the analysis of the factors driving agreement and disagreement on skill gaps is of major interest from the perspective of optimal training, it is also interesting to explore the impact of skill gaps on firm-level performance and the extent to which the observed impacts vary depending on whether the variable is measured from the perspective of the employee or employer. It may be the case that the impacts of skill gaps on outcome variables are broadly consistent irrespective of the measurement approach. This has been the case within the overeducation literature; for instance, there are three central measurement approaches to overeducation all of which tend to generate consistent impacts on earnings despite being poorly correlated (McGuinness, 2006). To examine the issue in the context of skill gaps, we include three different indicators of skill gap in a training cost model. We consider: a) an indicator of a *gap perceived both by employers and employees*, b) an

indicator of a *gap based on the employer measure only perceptions*, and finally c) an indicator of a gap *based on employee perceptions only*. It should be noted that these are not mutually exclusive categories .i.e. the gap based on employer perceptions will consist of all firms reporting gaps irrespective of whether there was mutual agreement with employees. It is reasonable to assume that the mutual skill gap variable represents a genuine measure of a skill deficiency at the level of the firm. As discussed earlier, measures based on employee or employer perceptions alone are potentially prone to subjective bias. The objective of the exercise is to establish the impact of genuine skill gaps on performance and the degree to which such impacts are sufficiently captured by measures restricted to stand alone employer and employee perceptions.

When estimating the training and labour cost equations, we control for the potential non-random relationship between skill gaps and productivity using the Heckman procedure (Heckman, 1978). We ensured that the model was properly identified by including a number of variables related to the probability of a skill gap that were subsequently excluded from the average wage cost equation[12]. The first stage equations from the Heckman procedure, which estimate the probability that a firm will experience a skill gap per se, are insightful in their own right and are presented in Table 6. The results vary somewhat depending on whether the dependant variable relates to mutually agreed gaps or those based on employer or employee responses. With respect to mutually agreed skill gaps, consistent with our multinomial model results, these are more common in firms with higher proportions of educated labour, lower levels of trade-union density, larger firms, those implementing HRM initiatives, implementing national \ industry wage agreements and employing a high proportion of shift-workers. The equation based on employee responses is similar to that for mutually agreed gaps; however, the variables capturing forms of wage bargaining and trade-union density are no longer significant in this model. The model estimated on employer responses is quite distinct from the other two; employer reported skill gaps were unrelated to the educational structure of the firm. Employer skill gaps were correlated with firm

[12]Essentially we exclude the HRM related variables from the labour costs equation. Results available from the authors.

size, HRM initiatives, wage bargaining structures and trade-union density. Interestingly, sectoral effects were not heavily evident in any of the skill gap models.

<Insert Table 6 here>

Table 7 shows the impact of skill gaps on training costs. . The skill gap variable is binary and takes the value 1 if a gap has been reported in one or more competency areas. The models are well specified and generally reveal that training expenditures tend to be higher in larger firms and those employing a higher share of workers belonging to professional bodies. Training costs were lower in firms employing high proportions of part-time workers and those engaged in shift work. With respect to training costs, significant impacts are present in models 1 and 2 which incorporate employer perceptions, but not in model 3, where skill gaps are measured in terms of employee perceptions only. Nevertheless, the model confirms our central hypothesis that employer perceptions of skill gaps are a primary driver of training expenditures and that the incorrect assessment of the distribution and intensity of skill gaps will lead to sub-optimal investments. The results indicate that the existence of skill gaps within firms raised average training costs by between €1,059 and €1,038 euro (2006 prices). The treatment terns are negative suggesting that firms experiencing skill gaps typically have lower characteristics that are associated with lower than average ex ante training expenditures. Table 8 looks at the impact of specific competency based skill gaps on training costs with the models suggesting that deficiencies in technology, IT and management all potentially raise training costs within firms.

<Insert Table 7 here>

<Insert Table 8 here>

The results from the labour costs models are presented in table 9 and comply with expectations. Average labour costs are positively related to the shares of educated workers, experienced workers, male employees and also with firm size. Average labour costs are lower in firms implementing the national wage agreement (see

McGuinness et al (2011), and those employing higher shares of part-time and migrant labour. After controlling for such variables, mutual skill gaps and those perceived by employers contribute to higher average labour costs; the gaps perceived by employees only are not statistically significant. The results from the selection adjusted average labour cost equations generally support the view that skill gaps are damaging for competitiveness, with deficiencies in the competencies of existing staff raising average labour costs by approximately 25 per cent under the combined measure, with the result broadly reflected in the equation utilising employer perceptions of skill gaps. The lambda terms indicate that the existence of skill gaps is non-random with respect to average labour costs, as those firms where skill gaps are present tend to have characteristics associated with lower ex ante labour cost i.e., they are more concentrated towards the lower end of the value added spectrum. Table 10 summarises the results from the labour cost models estimated to include controls for skill gaps across the various competency dimensions. In general, with the exception of IT, the results support the view that skill gaps in specific areas do not tend to adversely affect wage competitiveness; rather it is a combination of skill gaps across a range of competency areas that drive up average labour costs.

<Insert Table 9 here>

Summing up, we have found that perceived skill gaps raise are a key determinant of training expenditures, emphasising our central hypothesis that the misidentification of skill gaps will lead to sub-optimal investments. The analysis also provides tentative evidence that skill gaps are damaging to firm level competiveness. From a methodological perspective, the paper also demonstrates that the measurement approach is also important as measures of skill gaps based on employee perceptions may be prone to subjective bias.

4 Conclusions and Policy Recommendations

Skill gaps describe a situation whereby the skill levels of the existing workforce are perceived as insufficient to meet the productivity requirements of the firm. Skill

gaps, arguably, represent the primary determining factor for firm-level training and their misidentification is likely to lower competitiveness. To date, the literature has presented only descriptive evidence of the impacts of skill gaps on firm-level performance. Resorting to employer-employee matched data from the 2006 Irish National Employment Survey, our research has first explored the principal factors determining the correct (and incorrect) identification of skill gaps at the level of the firm. The research then assessed the extent to which the existence of skill gaps had a detrimental impact on company performance and the sensitivity of the observed effect to the measurement approach adopted.

Our results show that it is more common that employees recognised skill gaps when firms do so than vice versa. The level of agreement was higher for skills or competences related to IT, management or communication. After introducing a number of firm-level controls (size, sector...) and human capital controls (proportion of workers with different levels of education, share of migrants...) into a multivariate framework, the main factors driving the correct identification of skill gaps seem to be factors related to the degree of communication between management and the company. HRM and collective bargaining stand out among the factors that facilitate the mutual recognition of skill gaps or, alternatively, the absence of such arrangements tend to drive asymmetries where employers report problems not perceived by staff and vice versa. In the case of collective bargaining, it seems that collective bargaining at the sector or industry level is more decisive for facilitating this agreement than bargaining at other levels. This fits with the beneficial role of sector level agreement for skill formation found in other research. Sector or industry level is possibly the most suitable level to communicate or share skill gaps between employers and workers' representatives, and this common understanding of skill gaps is possibly reflected in the responses that employees and employers have given in the NES survey. Firms implementing the national wage agreement were also more likely to have mutual agreement in the area of skill gaps, however, this impact is more difficult to explain and while it may be driven by an omitted variable effect it is an area for future research.

While fostering or promoting, social dialogue at a sector level could be a way of diagnosing skill gaps among their workforce, a well-developed HRM works in the same direction. Performance evaluation, job description and consultation on job change are demonstrated to be valuable ways for management to diagnose the skill gaps among their workforce.

The proportion of skilled or highly-educated workers employed within the firm is also important for explaining the mutual recognition of skill gaps. To the extent that highly-educated workers occupy positions inside or near the hierarchy of the company, and thus can better transmit or share their perception of skill gaps with the ones in charge of the company, this can also be read as a result confirming the importance of communication for explaining skill gaps agreement.

The research confirms that skill gaps are a key determinant of training investments, which reinforces the importance of correctly identifying the factors that lead to the correct identification of skill gaps in order to improve the optimality of training investments. From a theoretical perspective, the work demonstrates that organisational structures and characteristics play an important role in the identification of skill gaps and, by definition, training requirements within firms. The research supports the view that the framework describing the training decision should be extended beyond a purely economic argument based around human capital investments and the relative role of general and specific skills (Becker (1964), Mincer (1974), Acemoglu & Pischke (1998)) to one that incorporates management structures and asymmetric information.

The research also demonstrated a statistically significant inflationary effect of skill gaps on average labour costs, even after controlling for the fact that the skill gaps are not randomly distributed with respect to the outcome variables. This in itself is an important finding with substantial implications for policy. However, potentially different conclusions can be drawn depending on the approach adopted for identifying skill gaps. Only gaps perceived by employers only, or commonly perceived by employers and employees, lead to a finding of an inflationary impact on training and labour costs and training expenditures. No impacts are found when

the analysis is carried out using employee perceptions alone, In sum, when asking ourselves whom to ask, or where to look at, in order to assess skill gaps, it seems more advisable to look at employers' perception, at least if we are concerned with firm-level performance. The fact that employees' perception of skill gaps cannot explain firm-level performance as well as employers' perception could be explained either because employees overestimate their competency levels, because they fail to recognise instances where their skill gaps are important for productivity or because employee responses actually capture future career aspirations, more than current job requirements. The identification of the sources of potential subjective bias in employee perceptions of their training needs is an area for further research.

Table 1: % Firms reporting Employer based Skill Gaps

	Incidence	% Also reporting Employee based gaps
Any	68	83.3
Technology	28.5	54
IT	35.1	60.7
Management	27.9	52.9
Languages	18.3	38.3
Communication	32.1	64.5
Numeracy / Lit	8.1	33.6
N	4035	100

Table 2: % Firms reporting Employee based Skill Gaps

	Incidence	% Also reporting Employer based gaps
Any	80	70.9
Technology	44.4	34.8
IT	47.3	45
Management	43.2	34.1
Languages	26.2	26.7
Communication	54.3	38.1
Numeracy / Lit	29	9.3
N	4035	100

Table 3: Factors Influencing agreement on skill gaps

VARIABLES	**Gap both**	**Tech**	**IT**	**Manage**	**Language**	**Comm**	**Num \ lit**
average experience	0.003	-0.005	0.022**	0.010	-0.024*	-0.003	0.035**
% male employment	0.058	0.950***	-0.112	0.046	0.052	-0.177	-0.117
% PT employment	0.543*	-0.018	0.080	-0.101	0.286	0.439	-0.186
% Basic education	0.176	0.416	1.341***	0.549	0.077	0.326	-0.561
% high school	0.859***	0.641	2.013***	1.719***	0.826	1.171***	0.379
% post sec	1.254***	1.325***	2.066***	1.491***	1.674***	1.277***	0.791
% sub degree	2.011***	2.017***	3.735***	3.601***	2.031***	2.460***	1.358
% graduate	2.087***	2.014***	3.539***	3.525***	2.391***	2.163***	1.875**
individual bargain	-0.000	-0.000	0.002	-0.000	-0.003	-0.000	0.001
bus level bargain	0.007	0.010**	0.011***	0.006	0.007	0.009**	0.012**
industry level bargain	0.007***	0.007**	0.008***	0.008***	0.008**	0.008***	0.009**
Nat wage agree	0.001	0.000	0.002	0.001	0.002	0.002	0.002
Other agree	-0.006*	-0.008*	-0.005	-0.008*	-0.006	-0.007*	-0.012
% Shift work	0.942***	1.083***	0.655**	0.933***	1.513***	1.272***	2.010***
% in prof bodies	0.457	0.872**	0.463	0.810*	0.061	0.210	0.572
Firm size (logged)	0.657***	0.766***	0.678***	0.876***	0.638***	0.899***	0.678***
T U density	-0.000	-0.003	0.002	-0.004	-0.001	-0.001	-0.006
% Migrants	-0.439*	-0.531	-1.268***	-1.065***	1.357***	-0.531*	0.230
% performance review	0.007***	0.012***	0.008***	0.008***	0.007***	0.009***	0.011***
% job description	0.003*	0.001	0.004**	0.007***	0.006**	0.004*	0.002
% consult change	1.002***	1.215***	1.099***	1.788***	0.698**	1.180***	1.614***
Constant	-1.264**	-2.902***	-3.890***	-4.640***	-3.304***	-3.012***	-4.673***
Observations	4035	2765	3000	2,743	1,792	3,145	1,666

*** p<0.01, ** p<0.05, * p<0.1

Models include industry controls which are not reported

Table 4: Factors Influencing Perceived Gaps among Employees Only

VARIABLES	Tot Gap	Tech	IT	Manage	Language	Comm	Num \ lit
average experience	0.014**	0.017**	-0.000	0.002	0.026**	0.028***	-0.023
% male employment	-0.376***	-0.435**	0.023	0.043	-0.035	-0.108	0.147
% PT employment	-0.367**	0.319	-0.126	0.294	-0.073	0.043	0.415
% Basic education	0.535*	0.948**	-1.142***	-0.039	0.701	0.444	2.055**
% high school	-0.059	0.815**	-1.082***	-0.469	0.372	-0.258	2.003**
% post sec	0.088	0.768*	-0.870**	-0.238	-0.235	-0.230	1.324
% sub degree	0.327	0.961**	-0.903**	-0.909**	0.785	-0.069	2.319**
% graduate	0.219	0.986**	-0.844**	-0.806*	0.488	0.431	1.431*
individual bargain	-0.001	-0.001	-0.001	-0.001	0.003	-0.001	-0.003
bus level bargain	-0.000	-0.002	-0.004**	-0.001	0.002	-0.002	-0.002
industry level bargain	-0.004**	-0.000	-0.001	-0.005**	-0.005**	-0.003*	-0.004
Nat wage agree	-0.003**	-0.002	-0.002*	-0.002	-0.004*	-0.003***	-0.005*
Other agree	0.001	0.001	-0.002	0.004	0.003	0.002	0.007
% Shift work	-0.256	-0.148	0.327	0.332	-0.548*	-0.082	-0.371
% in prof bodies	-0.310	-0.169	0.225	-0.273	0.763*	-0.005	0.275
Firm size (logged)	-0.148***	-0.186***	-0.051	-0.268***	-0.024	-0.272***	-0.084
T U density	0.005**	0.005**	-0.003	0.002	0.001	0.005**	0.003
% Migrants	-0.474**	-0.114	0.593**	0.090	-1.515***	-0.500**	-1.500***
% performance review	-0.004***	-0.006***	-0.001	-0.002*	0.000	-0.003**	-0.005**
% job description	-0.003***	0.001	-0.003**	-0.005***	-0.005***	-0.002**	0.002
% consult change	-0.095	-0.269	-0.096	-0.583***	-0.056	-0.247	-0.773*
Constant	-0.308	0.524	1.493***	2.196***	1.135	1.168***	1.942*
Observations	3,795	2,525	2,760	2,503	1,552	2,905	1,426

*** p<0.01, ** p<0.05, * p<0.1

Models include industry controls which are not reported

Table 5: Factors Influencing Perceived Gaps among Employers Only

VARIABLES	**Tot both**	**Tech**	**IT**	**Manage**	**Language**	**Comm**	**Num \ lit**
average experience	-0.004	0.002	-0.007	-0.019**	0.017	0.002	-0.035*
% male employment	-0.569***	-1.718***	-0.070	-0.567**	-0.119	-0.021	0.378
% PT employment	-0.273	0.122	0.237	0.638**	-0.253	-0.179	-0.127
% Basic education	-0.436	-1.355***	-1.485***	-0.668	-0.275	-0.212	-0.272
% high school	-0.657**	-0.299	-1.703***	-0.976*	-0.554	-0.151	0.401
% post sec	-1.255***	-1.397***	-1.512***	-0.562	-0.862	-0.133	-0.332
% sub degree	-1.453***	-1.093**	-2.648***	-2.191***	-0.515	-0.221	-0.202
% graduate	-1.604***	-0.951**	-2.476***	-1.997***	-2.131***	-0.347	-1.096
individual bargain	-0.001	-0.000	-0.003**	-0.000	0.005**	-0.001	-0.002
bus level bargain	0.000	-0.004	-0.003	0.000	-0.005	-0.003	-0.008
industry level bargain	-0.004*	0.001	-0.001	-0.005**	-0.006**	-0.002	-0.006
Nat wage agree	0.001	0.002	-0.001	-0.001	-0.000	0.002	0.000
Other agree	0.003	0.004	0.003	0.006	0.003	0.004	0.010
% Shift work	-0.824***	-0.303	0.289	0.145	-0.867***	-0.749***	-0.770
% in prof bodies	-1.260***	-1.548***	-0.676**	-1.077***	0.242	0.066	0.721
Firm size (logged)	-0.429***	-0.327***	-0.013	-0.039	0.168*	-0.353***	0.092
T U density	-0.000	0.003	-0.003	0.001	-0.002	0.004	0.007
% Migrants	-0.646**	-0.014	0.869***	-0.587*	-1.777***	-0.053	-1.729***
% performance review	-0.001	-0.005***	0.000	-0.001	-0.002	-0.000	-0.010***
% job description	-0.004***	0.000	-0.004**	-0.006***	-0.004*	-0.002	0.004
% consult change	-0.970***	-0.990***	-0.887***	-1.224***	-0.116	-0.857***	-1.377***
Constant	1.643***	2.767***	2.191***	2.997***	1.444**	0.914*	2.174*
Observations	3,795	2,525	2,760	2,503	1,552	2,905	1,426

*** p<0.01, ** p<0.05, * p<0.1

Models include industry controls which are not reported

Table 6: The Probability of Experiencing a Skill Gap (Marginal Effects)

VARIABLES	Mutual	Firm	Worker
average experience	-0.002	-0.003**	0.001
% male employment	0.064**	0.027	0.029
% PT employment	0.043	0.052	0.003
% Basic education	0.025	-0.070	0.080**
% high school	0.138**	0.032	0.125***
% post sec	0.172***	-0.004	0.180***
% sub degree	0.188***	0.008	0.225***
% graduate	0.153**	-0.010	0.207***
individual bargain	0.000	0.000	0.000
bus level bargain	0.000	0.000	0.000
industry level bargain	0.001***	0.001***	0.000
Nat wage agree	0.001***	0.001***	0.000
Other agree	-0.000	0.000	-0.000
% Shift work	0.093***	0.044	0.063***
% in prof bodies	0.092**	0.015	0.089***
Firm size (logged)	0.043***	0.022***	0.042***
T U density	-0.001**	-0.001*	-0.000
% Migrants	0.048	0.021	-0.010
% performance review	0.128***	0.051*	0.102***
% job description	0.001***	0.001***	0.000**
% consult change	0.001***	0.001***	0.000**
Manufacturing	0.138	0.161	
Electricity \ Gas \Water	0.137	0.138	0.045
Construction	0.092	0.111	0.006
Wholesale \ Retail	0.165	0.137	0.060
Hotels \ Restaurants	0.067	0.104	0.004
Transport \ Storage	0.137	0.127	0.027
Financial Inter	0.167	0.108	0.106***
Business Services	0.147	0.122	0.055
Public Admin	0.106	0.093	0.023
Education	0.113	0.120	0.011
Health	0.150	0.132	0.057
Observations	4,035	4,035	4,030

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Average Training Cost Models

VARIABLES	(1) Base	(2) Firm	(3) employee
average experience	1.958	3.444**	-0.843
% male employment	-32.534	0.962	31.479
% PT employment	-175.882***	-191.701***	-146.092***
% basic education	-14.695	97.989*	-4.966
% high school	-163.373***	-54.443	-22.749
% post sec	-165.365***	24.030	6.108
% sub degree	-20.827	173.076**	175.436
% graduate	2.461	181.931**	177.122
individual bargain	0.270	0.340	0.682**
bus level bargain	0.378	0.292	0.938
industry level bargain	-0.177	-0.087	0.929*
Nat wage agree	-0.248	-0.311	0.534
Other agree	0.098	-0.123	0.287
% Shift work	-166.208***	-115.780**	-86.907
% in prof bodies	178.772**	253.380***	281.137***
Firm size (logged)	48.299***	68.476***	101.170***
T U density	0.042	0.028	-0.826*
% Migrants	-103.615**	-75.741	-52.632
% consult change	-77.108*	-2.324	46.517
Gap both	1,059.139***		
lamda Gap both	-600.125***		
firm gap		1,138.696***	
lamda firm gap		-632.383***	
employee gap			125.222
lamda employee gap			-55.123
Constant	-273.128	-709.983***	-293.646
	(229.422)	(242.755)	(236.686)
Observations	4035	4035	4035
R-squared	0.102	0.102	0.091

*** p<0.01, ** p<0.05, * p<0.1

Models include industry controls which are not reported

Table 8: Impact on Average Training Costs of Individual Skill Gap Effects (selection adjusted)

VARIABLES	(1) Base	(2) Firm	(3) employee
Technology	678.729***	58.573**	815.384***
IT	686.316**	-8.008	64.308
Management	666.589*	1,854.322***	522.366
Languages	214.557	-64.914	-623.507
Communication	-23.022	49.918	468.758
Numeracy / Lit	401.712	-572.462	397.271
Constant	-168.646	-645.738**	-252.571
Observations	4035	4035	4035
R-squared	0.118	0.115	0.250

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Average Labour Cost Models

VARIABLES	(1) **Base**	(2) **Firm**	(3) **employee**
average experience	0.013***	0.014***	0.012***
% male employment	0.111***	0.116***	0.133***
% PT employment	-0.179***	-0.185***	-0.171***
% basic education	0.056	0.089	0.093
% high school	0.123*	0.147**	0.210***
% post sec	0.083	0.129*	0.197**
% sub degree	0.180**	0.224***	0.313***
% graduate	0.405***	0.448***	0.524***
individual bargain	0.000	0.000	0.000**
bus level bargain	0.000	0.000	0.000
industry level bargain	-0.001*	-0.001**	-0.000
Nat wage agree	-0.001***	-0.001***	-0.000*
Other agree	-0.000	-0.000	-0.000
% Shift work	-0.105**	-0.096**	-0.066
% in prof bodies	0.076	0.092*	0.124**
Firm size (logged)	0.034***	0.037***	0.057***
T U density	0.001	0.001	0.000
% Migrants	-0.175***	-0.170***	-0.167***
% consult change	0.074*	0.087**	0.139***
Gap both	0.252*		
lamda Gap both	-0.158*		
firm gap		0.340**	
lamda firm gap		-0.224**	
employee gap			-0.197
lamda employee gap			0.132
Constant	2.387***	2.258***	2.452***
	(0.118)	(0.127)	(0.125)
Observations	4035	4035	4035
R-squared	0.237	0.238	0.237

*** p<0.01, ** p<0.05, * p<0.1

Models include industry controls which are not reported

Table 10: Impact on Average Labour Cost of Individual Skill Gap Effects (selection adjusted)

VARIABLES	(1) Base	(2) Firm	(3) employee
Technology	0.080	-0.022	-0.039
IT	0.356*	0.555	0.276
Management	0.171	-0.040	0.012
Languages	-0.373**	-0.228	-0.058
Communication	-0.038	-0.025	-0.079
Numeracy / Lit	-0.604	-0.613	0.133
Constant	2.356***	2.249***	2.471***
Observations	4035	4035	4035
R-squared	0.251	0.249	0.250

*** p<0.01, ** p<0.05, * p<0.1

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