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Who Should We Ask? Employer and Employee Perceptions of Skill Gaps within Firms

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Abstract: Using the employer-employee matched National Employment Survey of Ireland carried out in 2006, this paper compares the skill gaps as perceived by managers and employees located within the same firm. The paper looks at the main drivers of agreement/disagreement on the perception of skill gaps and considers the extent to which the way of measuring these gaps helps to explain outcome variables such as labour costs and training expenditures. The research finds that both human resource management processes and collective bargaining arrangements are important factors in facilitating agreement of training needs. Skill gaps were found to increase average training costs and average labour costs. Finally, the evidence suggests that employee perceptions of skill gaps may be prone to higher levels of subjective bias.

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Who Should We Ask? Employer and Employee Perceptions of Skill Gaps within Firms

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: workers' earnings, job satisfaction, job turnover and training participation (McGuinness, 2006, Verhaerst & Omey, 2006, McGuinness & Wooden, 2010), Mavromaras et al, 2013). However, to date, the mismatch literature has focused almost exclusively on the impacts of overeducation and overskilling, and has largely ignored the impacts of skill gaps at the level of the individual or firm. Skill gaps describe the scenario whereby the skill levels of the existing workforce are insufficient to meet the organisational-level performance requirements of the firm. The lack or research 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.

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 through 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, the existing research in the area is limited and largely descriptive. This paper seeks to address this gap in the literature by providing a robust empirical assessment of the impact of skill gaps on firm-level training and labour costs.

In addition to a lack of information on the impacts of skill gaps, it is unclear from the literature to what the principal drivers of skill gaps are or exactly how the phenomena should be measured. Skill gaps can be measured on the basis of the subjective views of both workers and firms. It is unclear to what extent the approach adopted to measuring skill gaps matters. By assessing the factors that drive any misalignment between employer and employee views on worker competencies, the research will seek to identify the main factors

driving differences between the views of management and workers. We will also consider the extent to which the impacts of skill gaps vary according to the measurement approach adopted.

The paper has two central aims (1) to assess the determinants and relationship between skill gaps measured from the perspective for employers and employees and (2) to measure the impact of skill gaps on firm-level performance. The paper is structured as follows: Section 2 describes the data and methods used in the study, Section 3 outlines the central results arising from the analysis and Section 4 provides conclusions and policy recommendations.

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 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

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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.

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.

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:

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

$$\bar{Y} = \alpha + \beta_1 \bar{H} + \beta_2 F + \beta_3 gap_i + \lambda gap_i + \varepsilon \qquad (2)$$

$$\overline{Tc} = \alpha + \beta_1 \bar{H} + \beta_2 F + \beta_3 Gapi + \lambda gapi + \varepsilon \qquad (3)$$

Agree is a binary variable indicating that both employers and employees believe that a skill gap exists. *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. Firm level controls included in the model relate to firm-size, sector, the mode of wage bargaining and HRM variables

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

related to the proportion of staff subject to an annual performance review or in receipt of a job description. 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, $\overline{Y}$ represents average firm labour costs and $\overline{Tc}$ average training 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 earnings and / or training 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 gaps

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. 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 may reflect future career aspirations more than current job requirements.

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.

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 that agree on skill gaps (skill gaps agreement). Given that there exist a number of mutually exclusive skill gap states (j=1,2,3,4) where 1 refers no skill gaps, 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. 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, skill gap agreement 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; the provision of job descriptions is also important but to a somewhat lesser degree. With respect to industrial sector, relative to the Other Services base case, agreement was consistently less likely in the Transport / storage, Wholesale / retail and Public administration sectors[5]

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

Table 4 analyses the determinants of firms reporting employee specific gaps relative to the base case of firms where there is agreement between employees and employers[6]. 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[7], 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[8]. The human capital characteristics of the workforce are 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.

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. We see that asymmetries across most skill dimensions are again more common

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6 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.

7 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;)

8 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 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.

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 specific 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 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, skill gaps unilaterally perceived by employers only 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.

Therefore, to conclude, a general finding arising from our research is the importance of collective bargaining, HRM practices and firm size in promoting skill gaps agreement or, alternatively, an absence of such attributes contributing to information asymmetries.

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 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[9].

[9] 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

Unlike collective bargaining, HRM is a unilateral effort of the company to investigate the skill gaps among the workforce. It is reasonable to think that companies with performance review among the workforce, where job description is 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 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).

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, it would lack any strong implication for policy if 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 labour 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 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.

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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.

When estimating the labour cost and training 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[10]. 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, 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 size, HRM initiatives, wage bargaining structures and trade-union density. Interestingly, sectoral effects were not heavily evident in any of the skill gap models.

The results from the labour costs models are presented in table 7 and comply with expectations. Skill gaps relate to a gap being reported in one or more competency areas. 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 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 lower ex ante labour cost i.e., they are more concentrated towards the lower end of the value added spectrum. Table 8 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.

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

Table 9 shows the impact of skill gaps on training costs and, once again, we see that that 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. 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 again negative suggesting that firms experiencing skill gaps typically have lower than average training expenditures. Finally Table 10 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.

Summing up, we have found that the skill gaps commonly perceived by employers and employees, or by employers only, are the ones that seem relevant for both labour and training costs, whereas skills gaps perceived by employees only are not relevant in these respects. The results suggest that skill gaps are damaging to firm level competiveness and also that 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. To date, the literature has presented only descriptive evidence of the impacts of skill gaps on firm-level performance. Using to employer-employee matched data from the 2006 Irish National Employment Survey, our research has first explored the rate of agreement between employers' and employees' perception of skill gaps at the firm level. It has also explored the drivers or determinants of this consistency. The research then assessed the extent to which either employers' or employees' perception of skill gaps is more decisive in explaining firm level performance, looking at the degree to which each perception helps explaining labour costs and training expenditures.

Our results show that it is more common that employees recognised skill gaps when management 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 immigrants...) into a multivariate framework, the main factors driving the agreement between employers' and employees' perception of skill gaps seem to be factors related to the degree of communication between management and the company. Human resource management processes 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 employees 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 information on 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 greater 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 human resource management 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 skill gaps agreement / disagreement. To the extent that highly-educated workers occupy positions inside or near the top of the company hierarchy 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 higher levels of agreement on skill gaps.

The second part of the analysis has demonstrated a statistically significant inflationary effect of skill gaps on both average labour costs and training 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. 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***
Manufacturing	-0.805	-1.293	-1.251	-1.752	-0.934	-1.233	-13.363
Electricity \ Gas \Water	0.201	-0.110	0.399	-0.049	0.273	-0.453	-0.314
Construction	8.913	9.068	8.413	10.549	-1.895	8.147	
Wholesale \ Retail	-0.795**	-0.955**	-1.079***	-1.088***	-1.003**	-1.594***	-1.051*
Hotels \ Restaurants	-0.411	-1.309***	-0.147	-0.511	-0.543	-0.147	-0.877*
Transport \ Storage	-1.150***	-3.051***	-1.647***	-1.090***	-0.928**	-0.742**	-2.173***
Financial Inter	-0.791*	-1.797***	-0.309	-0.702	-0.812	-0.530	-3.207**
Business Services	1.060	0.109	1.392	0.724	0.873	1.219	0.352
Public Admin	-0.713**	-1.041***	-0.442	-0.788**	-0.439	-0.868**	-1.061*
Education	-1.223*	-2.283***	-0.910	-1.547**	-1.133	-0.898	-2.001
Health	-0.382	-0.504	-0.003	-0.600	-0.661	-0.395	-0.298
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

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*
Manufacturing	-0.120	-0.298	-0.202	0.226	0.460	-0.767	10.566
Electricity \ Gas \Water	-0.132	-0.053	-0.111	0.254	-0.497	0.469*	-0.066
Construction	0.165	-0.253	-0.037	-1.128	8.076	0.761	
Wholesale \ Retail	0.279	-0.078	0.304	0.457*	-0.031	0.712***	-0.054
Hotels \ Restaurants	0.092	0.420**	-0.080	0.240	-0.012	-0.308*	0.231
Transport \ Storage	0.587***	1.201***	0.391	0.566**	-0.272	0.001	0.702
Financial Inter	-0.149	0.314	-0.199	0.156	-0.033	-0.396	2.109*
Business Services	0.101	0.100	0.215	0.380	0.008	0.207	0.764
Public Admin	0.078	-0.050	-0.004	0.325	-0.308	0.201	0.444
Education	0.358	0.704	-0.008	0.692	0.383	-0.059	0.918
Health	0.027	-0.076	-0.291	0.124	0.173	-0.017	-0.719
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

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***
Manufacturing	0.789	1.293	1.345	0.743	0.490	0.653	10.641
Electricity \ Gas \Water	0.085	0.594*	0.245	0.428	0.160	1.121***	-0.030
Construction	-7.855	-9.630	1.952	-10.367	8.696	2.645	
Wholesale \ Retail	0.443*	0.549*	0.643**	0.610**	0.359	1.104***	0.154
Hotels \ Restaurants	-0.151	0.750***	0.068	-0.022	0.165	-0.128	0.296
Transport \ Storage	0.854***	2.104***	0.941***	0.078	0.663*	0.463*	1.494**
Financial Inter	0.435	1.146***	0.177	-0.070	0.477	0.421	2.347*
Business Services	-1.574*	1.068**	-1.866**	0.330	0.108	-1.029*	0.599
Public Admin	-0.244	0.548**	-0.089	0.232	-0.616	0.181	0.684
Education	0.086	0.447	0.100	-0.052	0.423	-0.105	0.916
Health	-0.013	0.249	0.150	0.100	0.477	0.288	-0.274
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

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 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 8: 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

Table 9: 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

Table 10: 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

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