CPPR
Centre for Public Policy for Regions

Working Paper 25

Skills Gaps and Hard to Fill Vacancies at Establishments in Scotland

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ABSTRACT

This paper has two aims: first to identify the determinants of the incidence of three establishment level outcomes viz. skills gaps, hard to fill vacancies and no training taking place, done to ascertain the extent to which the determinants of the three variables are similar; secondly to examine whether combinations of the three establishment outcomes in question are related. This first part of the investigation makes use of a binomial probit model, the second a bivariate probit model. The data set examined is the establishment based Scottish Employers' Skills Survey of 2008.

The observed determinants of the three establishment are seen to be quite different. Skills gaps are relatively more likely to be found in establishments in the private sector; in establishments at which an element of the training undertaken is done to meet legal requirements; in establishments which have a training plan; which have recently changed their methods of working; and which have recently changed their senior management. Skills gaps are relatively less likely in smaller sized establishments and establishments which make extensive use of highly skilled labour. Hard to fill vacancies are relatively more likely in larger sized establishments; in establishments in the private sector; and in establishments which make use of part time and temporary staff. Hard to fill vacancies are relatively less likely in the smaller sized establishments. No training is relatively more likely in the two smallest sized establishments; in establishments which are in the private sector; and which are single plant enterprises. No training is relatively less likely in establishments which have an element of their training required to meet legal conditions; which employ a highly skilled workforce; which employ workers on temporary contracts; and which have a training plan.

Two relationships are identified in the three bivariate probit estimations: one between the incidence of hard to fill vacancies and skills gaps; and the other between the incidence of skills gaps and no training taking place. Whereas the nature of the relationship between the two dependent variables in the first instance is positive, the nature of the relationship between the two dependent variables in the second instance is negative. The bivariate probit model controls for observable variables denoting geography, size and sector. Consequently, it is speculated that a possible source of the unobservable variables identifying the two relationships is variables associated with policy (perhaps more especially human resource management policy) in operation at the workplace and/or process.

Skills Gaps and Hard to Fill Vacancies at Establishments in Scotland [1]

1. INTRODUCTION

Skills gaps and hard to fill vacancies, although conceptually different phenomena, have similar implications for organisations. In the short run, both entail less than optimal working which may result in shortfalls in product/service quantity and/or quality. In the longer run, both may constrain the introduction of new products/services and/or new working processes/practices by which these products/services are produced/delivered. Ultimately, both impact detrimentally upon corporate performance, however this is measured.

Given the existence of problems such as skills gaps and/or hard to fill vacancies, training is an appropriate policy option. Consequently, positive correlations between the incidence of training and the incidence of both skills gaps and hard to fill vacancies are to be expected. In related work, Sutherland (2010) has estimated that the presence of skills gaps at establishments increases the likelihood of training being done by 11 percent. However, in the same estimation, the sign of the coefficient of the variable denoting the presence at establishments of hard to fill vacancies is negative (although this result is not statistically significant).

The aims of this paper are twofold. First, to identify the determinants of the incidence at establishment level of skills gaps, hard to fill vacancies and no training taking place, principally to ascertain the extent to which the determinants of the three variables are similar. This part of the investigation makes use of a binomial probit model. Secondly, to examine whether combinations of the three establishment

[1] This work contains statistical data from ONS which is Crown copyright and reproduced with the permission of the controller of HMSO and Queen's Printer for Scotland. The use of ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates. Both for this paper and my other research which makes use of the 2008 Scottish Employers' Skills Survey data set, I am indebted to the following: Ben Davies of IFF for providing me with the codebook associated with the questionnaire, which facilitated my initial examination of the original data set: members of the MAUS team, for their co-operation throughout the process of statistical analysis: Andy Dickerson and John Forth for their advice and assistance with respect to the ramifications and implications of 'stratification' when applying Stata's 'survey design' routines: and Patrick Watt, of Skills Development Scotland, for his encouragement, interest and support. The usual disclaimer applies.

outcomes in question are related. This part of the investigation makes use of a bivariate probit model.

The structure of the paper is as follows. The next section provides some context. Section 3 describes the data set. Section 4 identifies the models used and outlines the estimation strategy employed. Section 5 presents the results. A final section concludes.

2. CONTEXT

Skills gaps are identified when an employee does not possess the skills required to do the job he/she does currently proficiently. Their magnitude and nature and, therefore, their impact will vary across workplaces, depending upon the number of employees involved and the nature of the skills gaps in question. For example, gaps in terms of organising and planning skills on the part of the establishment's management team may have a greater impact upon performance than gaps in terms of customer handling skills on the part divisional sales staff.

Some skills gaps are inevitable. For example, they may have their origin in an employee not being long enough in the job to acquire the necessary on-the-job experience to be able to do the job proficiently. Some skills gaps may have their origin in the consequences of previous planned actions on the part of management, for example the introduction of new products/services, new processes or new methods of working. Others, however, may have their origin in managerial omission or error. For example, the failure to design and implement training programmes to accommodate change; or the inadequacies of existing recruitment and selection policies which result in job offers to individuals now perceived to be lacking in the required skills.

In principle, management have a number of policy options to address the problem of skills gaps. They may change their channels and sources of recruitment; they may implement alternative methods of screening potential employees; or they may opt to introduce new training programmes or enhance/extend existing ones. Although less likely, they may seek to change their products/services and the means by which these are produced/delivered to accommodate the skills gaps, either 'up-skilling' or 'down-skilling' their labour requirements accordingly; they may sub contract work, where

possible; or, more drastically, they may choose to 'exit', either by means of closure or relocation.

Given the dynamism within the labour market, and irrespective of the macro economic conditions prevailing, most establishments have vacancies at any one point in time as individuals quit voluntarily (MacKay and Jones, 1989). Should the establishment choose to do so, most of these vacancies will be filled in time. At some establishments, however, some vacancies may be deemed 'hard to fill', reflected for example in the length of time current vacancies remain open.

'Hard to fill' vacancies may arise for several distinct reasons, expediently subdivided into two categories viz.: the quantity of applicants; or the quality of the applicants. There are several reasons explaining why few individuals may apply for certain jobs, most of them reflecting the nature of the job in question. For example, the wages and conditions of employment may be less than attractive relative to those associated with other job openings within the local labour market; or travel to the location of the establishment in question may be inconvenient/expensive. The unacceptable quality of the applicants may be attributable to perceived inadequacies in terms of their attitude to work, their experience, their qualifications and/or their skills. Conventionally, when the hard to fill vacancy has its origin in candidates lacking in experience, qualifications and/or skills, this is deemed to be a 'skills shortage'. 'Skills shortages', therefore, are a potential policy problem which has its origins in the external labour market.

In principle, there are a number of policy options given the existence of hard to fill vacancies which are attributable to the nature of the job. The most frequently used is over time working, a policy option which avoids recourse to the problematic external labour market. Engaging with the external labour market, however, the establishment may change its channels of recruitment and/or extend its sources of recruitment, perhaps geographically, perhaps to employ migrant workers. Within its own internal labour market, it may change the job specification; and/or it may make its wages and terms and conditions of employment more competitive, given that it has the scope and latitude to do so. To the extent that skills shortages are an external labour market phenomenon, there is little that the individual establishment can do other than to up-

skill via training some of its existing employees and/or drop its hiring standards but compensate for the inadequacies of the new recruits by providing the necessary training, assuming the finance and scope to do so and further assuming that the benefits which accrue from implementing the selected option/s outweigh their costs.

'Skills shortages' are conventionally assumed to be a policy problem because of the manner in which they are perceived to act as constraints to economic development, although as Green and Aston (1992) observe "the phrase 'skill shortages' is but a catch-all for a plethora of labour market problems" (p. 287) and a somewhat inadequate measure of recruitment difficulties experienced by organisations. From the outset, the spatial implications of skills shortages were noted, with some studies seeking to examine their inter- and intra-regional variation (e.g. Green and Owen, 2003) not least to advocate the need for local policy responses to local problems (e.g. Campbell and Baldwin, 1993).

The literature of specific reference to this working paper, however, is establishment/organisation based micro studies of the determinants of the incidence of diverse indicators of 'skills shortages', variously defined. Although both the nature of the indicator and how it is measured are very much conditioned by the data set used, the estimation methodology is common throughout: a relevant dichotomous dummy dependent indicator variable is identified and its determinants investigated, where the independent variables reflect (wherever possible) establishment size, sector, the nature of both labour and technology employed, the nature of the market served and human resource management policies and practices in operation at the establishment/organisation. Notably:

- Haskel and Martin (1993): who investigate 'skill shortages', explored via questions which relate to difficulties in filling vacancies in the 1984 Workplace Industrial Relations Survey:
- Green et al (1998): who investigate employers experiences with respect to 'skills shortages', 'filling vacancies' and 'deficiencies in the qualities of their existing workforce', using the 1991 Employer Manpower and Skills Practices Survey (EMSPS):

- Haskel and Martin (2001): who investigate 'skill shortages', 'hiring difficulties' and 'hard to fill vacancies', again using the 1991 EMSPS: and
- Watson et al (2006a): who investigate employers perceptions of 'skills deficiencies' using six indicators (none of which relate to Green and Ashton's (1992) definition of the same), including 'current skills gap' and 'hard to fill vacancies' using a primary data set collected from a survey of employers in Dorset.[2]

Throughout, in separate logit/probit estimations, the importance of size, sector and, sometimes, policy in determining the respective dependent variables is established. Additionally, however, Haskel and Martin (2001) report that the determinants of (their definition and measurement of) skill shortages, hiring difficulties and hard to fill vacancies are "broadly similar" leading them to conclude that they are "different symptoms of the same underlying process" (p. 643). Green et al (1998) pursue a similar line of enquiry, seeking to examine the extent of the overlap between the experience of a skill shortage and (separately) the experience of a hard to fill vacancy and the experience of a deficiency in the quality of the workforce. They do so by investigating and comparing the determinants of skill shortage and of hard to fill vacancies by means of a bivariate probit model. Although the overlap between the two variables is partial, nonetheless, Green et al conclude that, from the perspective of the employer, the term 'skill shortage' appears to mean something "wider or different" (p. 167) from 'hard to fill vacancy'.

The research associated with this working paper is both a development and extension of the research reported above. It aims to identify the determinants of the incidence at establishments of skills gaps, hard to fill vacancies and no training taking place. Further, it seeks to examine the overlap between combinations of these three establishment outcomes, investigating the possibility that they may be related.

[2] Green and Ashton (1992) define a 'skills deficiency' as "the difference between current and some suitably defined optimum level of skills" (p. 288).

3. THE DATA SET

The Scottish Employers' Skills Survey of 2008 is the fifth in a series of large scale surveys undertaken to obtain employers' perspectives on a diverse range of skills related issues e.g. vacancies, including 'hard to fill' vacancies, skill shortages, skill gaps and training. It is establishment based.

The population from which the sample of establishments is taken is obtained from the ONS' Inter-Departmental Business Register. The population sampled is defined as all establishments in Scotland. Quota sampling methods are used and the survey is multi-stage in its design. There are three elements to the sampling frame viz. 'geography' (the 11 Scottish Further Education Funding Council Areas); 'sector' (six Sector Skills Council industry groupings); and 'size' (six employer size categories).[3] 14,052 establishment were contacted and positive responses were obtained from 6,274, a response rate of 45 percent. Where positive responses were obtained, telephone interviews were conducted with the senior person responsible for human resource and personnel matters. When observations which had incomplete information on the variables used in the analysis were dropped, 5,635 observations remained.

The original report focussed upon four issues (FutureSkills Scotland, 2009):

1. The relative importance of skills-related issues, as compared with other challenges facing employers, such as their cash flow problems, the imminent economic downturn etc.:
2. The types of jobs in which skills shortages and skills gaps were most/least prevalent:[4]
3. The causes of skills shortages and skills gaps, their consequences and the nature of employers' responses to both: and

[3] Complex survey data lead to a sample which may be weighted, clustered and stratified. Failure to accommodate these features, where appropriate, may result in conservative overestimates of standard errors, although not necessarily different values of the coefficients (Cameron and Trivedi, 2005 and 2009). However, the data set is only weighted because Stata's survey routines do not accommodate bivariate probit estimation.

[4] For purposes of the report, 'skills shortages' are defined as 'a specific type of hard-to-fill vacancy that occurs when an employer can't find applicants with the skills, qualifications or experience to do the job', where other possible reasons for the existence of hard-to-fill vacancies are acknowledged. 'Skills gaps' are defined as instances 'when an employer thinks a worker doesn't have enough skills to perform their job with full proficiency.'

4. The nature and extent of training paid for by employers, examined in two ways viz. 'training incidence' and 'training intensity'.[5]

The principal foci of this working paper are three issues, each identified as a dependent variable in the estimations which follow viz.

- Whether 'skills gaps' are prevalent at the establishment;
- Whether some of the vacancies at the establishment are described as 'hard to fill'; and
- Whether no training is undertaken at the establishment

The dependent variables, therefore, measure incidence not intensity. As such, they ignore the often crucial dimensions of 'depth' and 'width' (Bosworth, 1990). For example, the number within each occupation associated with skills gaps at an establishment is ignored. Similarly, the extent of skills gaps across occupations within an establishment is ignored.

The variable 'hard to fill' vacancies is used in preference to the more traditional 'skills shortages'. Skills are social constructs.[6] Oliver and Turton's (1982) seminal study of the salience to employers of social skills such as dress, manner, punctuality, reliability and respect for both authority and others, for example, has contemporary resonance in the context of aesthetic labour (Warhurst and Nickson, 2007).[7] Consequently, rather than seek to differentiate between the reasons why vacancies are hard to fill, that vacancies are hard to fill is the dependent variable of choice. Nonetheless, neither 'skills gaps' nor 'hard to fill vacancies are objective realities. Consequently there will be an inevitable element of measurement error in the

[5] 'Training incidence' is seen as an "establishment based measure which permits examination of the circumstances under which training takes place" (FutureSkills Scotland, 2009, p 43). In the original report, training incidence is examined when training of any sort is undertaken, by the nature of the training provided. In contrast, 'training intensity' is seen as a "employee based measure which can help to answer questions about how much training takes place and who receives it" (Future SkillsScotland, 2009, p 43). In this instance, however, training intensity refers only to off-the-job training undertaken.
[6] As Green and Ashton (1992) comment: "….the labels used to describe job vacancies as 'skilled' often tell us less about the actual technical content of the job than about the sex of the persons likely to get the jobs" (p. 296).
[7] Aesthetic labour is associated with instances in which the individuals supplying the service in question become part of the commodity consumed. See also Heckman and Masterov (2005) for a discussion of the importance of what are often referred to as 'non cognitive skills' in the labour market in Scotland.

estimations. However, given that all the respondents to this survey are responsible for human resource and personnel matters, in contrast to the important finding of Watson et al (2006b), different perceptions of the outcomes attributable to holding different positions within the establishment will not be a component of this error.[8]

4. THE MODELS AND THE ESTIMATION STRATEGY

First, a binomial probit model is used to identify the determinants of the three establishment outcomes. This model conforms to the standard format viz.:

$$\mathbf{y_i} = \mathbf{X_i}\boldsymbol{\beta} + \boldsymbol{\varepsilon_i}$$

where $\mathbf{y_i}$ is the establishment outcome in question; and $\mathbf{X_i}$ $\boldsymbol{\beta}$ and $\boldsymbol{\varepsilon_i}$ are, respectively, a vector of observable independent variables, a set of coefficients to be estimated, and an error term (Cameron and Trivedi, 2005 and 2009; Long and Freese, 2006). In the estimations, $\mathbf{y_i} = 1$ if:

- the establishment reports the presence of skills gaps;
- the establishment reports the presence of hard to fill vacancies; or
- the establishment reports that no training of any sort has been provided during the last 12 months

(and = 0 otherwise, in each case).

The vector of independent variables reflects the location of the establishment, its size, its sector, some structural characteristics, some change events of relevance, and some management policies of similar relevance. The names and descriptors of these variables are identified in Table 1.

The second aim is to examine whether or not combinations of the three dependent variables are related. This hypothesis is tested best by the application of a bivariate probit model, a model which makes possible an examination of two separate binary dependent variables, allowing for a correlation between the error term of the two

[8] In a related publication, Watson et al (2006a) contend: "…a 'skills deficiency' is not necessarily a measure that is based on objective reality…. it depends to a large extent upon the perspective of the individual that is responding to the survey. (p. 1762).

equations, which recognises that there may be some unobservable characteristics of the establishments which influence both variables.

The bivariate model estimated builds upon the binomial probit model of before and is as follows:

$$\mathbf{y_1} = \mathbf{X_1}\boldsymbol{\beta_1} + \boldsymbol{\varepsilon_1}$$

$$\mathbf{y_2} = \mathbf{X_1}\boldsymbol{\beta_2} + \boldsymbol{\varepsilon_2}$$

where $\mathbf{y_i}$ and $\mathbf{y_2}$ are any two of the three identified establishment outcomes in question; $\mathbf{X_i}$ is a vector of independent variables common to both outcomes (and the same as that used in the three estimations of the binomial probit model); $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_2}$ are sets of coefficients to be estimated; and $\boldsymbol{\varepsilon_1}$ and $\boldsymbol{\varepsilon_2}$ are error terms, *inter alia*, used to examine the nature of the unobservable characteristics of both outcomes and to test the hypothesis of being related (Baum, 2006).[9]

5. THE EMPIRICAL RESULTS

With two binary variables four possible outcomes may be observed. Cross tabulating the appropriate variables demonstrates that:

- 7.76 percent of all establishments report that some vacancies are hard to fill and hard to fill vacancies exist (Table 2)
- 8.89 percent of all establishments report that skills gaps exist and no training is done (Table 3)
- 3.74 percent of all establishments report that some vacancies are hard to fill and no training is done (Table 4)

[9] Whereas the binomial probit model assumes that the error terms $\boldsymbol{\varepsilon_1}$ and $\boldsymbol{\varepsilon_2}$ are uncorrelated (i.e. that Cov ($\boldsymbol{\varepsilon_1}$, $\boldsymbol{\varepsilon_2}$) = 0), the bivariate probit model relaxes this assumption, thereby facilitating an investigation of whether or not the fit of the model is improved by a joint analysis of the two outcomes in question. The central parameter of interest is the estimate of the covariance between the error terms (rho). When rho is significantly different from zero, this implies the existence of some relationship between the dependent variables which is not to be found in the observable independent variables identified, but, instead, in unobservable characteristics which are common to both error terms. Alternatively, when rho is not significantly different from zero, the two outcomes are not related and the bivariate estimation is redundant.

The focus of the investigation, therefore, would appear to be upon a small subset of establishments in Scotland.

The three variables in question are associated statistically, as per the results of the Pearson chi-square tests reported in Tables 2, 3 and 4. Their pair wise correlations are reported in Table 5. Whereas there is a (statistically significant) positive correlation between the incidence of skills gaps and hard to fill vacancies, there are (again statistically significant) negative correlations between no training taking place at the establishment and the incidence of hard to fill vacancies and skills gaps.

To identify the determinants of the three variables, binomial probit models are estimated for the three variables *skillsgaps, hardtofill* and *notraining*. These results are reported in Tables 6, 7 and 8, respectively.

First, in the context of the binomial probit estimation of *skillsgaps*, the signs on the variables associated with Sector Skills Council Key Groups vary, relative to the reference category, some being positive, some being negative but none being statistically significant (Table 6).[10] Skills gaps are less likely to be found in the relatively smaller sized establishments and more likely to be found in the relatively larger sized establishments, although only the former set of results is statistically significant. Skills gaps are also more likely to be found in establishments in the private and voluntary sectors, relative to the reference category of public sector establishments, although only the result for the former is statistically significant. In the context of the other statistically significant results, skills gaps are more likely to be found in establishments at which an element of the training undertaken is done to meet legal requirements; establishments which have a training plan; have recently changed their methods of working; and have recently changed their senior management. However, skills gaps are less likely to be found in establishments which make extensive use of highly skilled labour.

[10] Statistically significant at ($P < 0.05$), that is, the criterion used throughout the paper.

Next, in the context of the binomial probit estimation of *hardtofill*, the signs on the variables associated with Sector Skills Council Key Groups again vary. Relative to the reference category, some are positively signed, some are negatively signed but none is statistically significant (Table 7). Perhaps the most salient results relate to the variables associated with establishment size, where, relative to the reference category *sizecat4*, in a set of statistically significant results throughout, hard to fill vacancies are less likely in the relatively smaller sized establishments and more likely in the relatively larger sized establishments.[11] Relative to establishments in the public sector, hard to fill vacancies are more likely in both the private and voluntary sectors, although only the former result is statistically significant. Hard to fill vacancies are more likely in establishments which make use of part time and temporary staff.

Finally, in the context of the results of the binomial probit estimate of *notraining* the variables associated with the Sector Skills Council Key Groups, relative to the reference category of *publicservices,* no training is only less likely in *kshi_tec*, although this result is not statistically significant. In the one statistically significant result in this category, no training is 16 percent more likely in *ksfood*. No training is more likely in the two smallest sized establishments, relative to the reference category of *sizecat4*. By contrast, again relative to the same reference category, no training is less likely in the two largest sized establishments, although these latter results are not statistically significant. No training is more likely in the private sector and less likely in the voluntary sector, relative to the reference category of the public sector, however only the former result is statistically significant. Additionally, no training is more likely in single establishments. Conversely, no training is less likely in: establishments which have an element of their training required to meet legal conditions; establishments which employ a highly skilled workforce; establishments which employ workers on temporary contracts; and establishments which have a training plan.

[11] In some respects, this outcome is contrary to expectations. To the extent that smaller size establishments tend to need to look more to the external labour market for labour – in contrast to the larger sized establishments' scope to make use of their internal labour markets – *a priori* and *ceteris paribus*, one would expect that smaller sized establishments would be more likely to report hard to fill vacancies than larger sized establishment.

In terms of the outcomes of the binomial probit estimations, the observed determinants of the three establishment outcomes, therefore, are different. That said, there is some similarity between the determinants of *hardtofill* and *skillsgaps* (in that 19 of the 25 variables reported in the respective tables are similarly signed). The most discernible similarities between *hardtofill* and *skillsgaps* relate to variables denoting size and sector. There are discernible differences with respect to certain other variables. For example, whereas the incidence of hard to fill vacancies is more probable in establishments which make use of part time and temporary workers, the incidence of skills gaps is more probable in establishments which have a training plan and have experienced change of some sort at the workplace.

To examine the hypothesis of a relationship between the three outcomes, bivariate probit models are estimated. These three results are reported in Tables 9, 10 and 11.

The results of the estimation of the bivariate probit of *hardtofill* and *skillsgap* are reported in Table 9. The only difference between results for the former variable and the corresponding binomial probit estimation of *hardtofill* is that the variable *single* changes its sign. Otherwise, both the magnitudes of the other coefficients and their 'P> |z|' values are very similar. There is no difference in the results for *skillsgap* between the corresponding binomial biprobit estimation and the biprobit estimation. For all variables, the signs of the coefficients, their magnitudes and their respective 'P>|z|' values are very similar across the two estimations. The value of rho is estimated at 0.17 . It is positively signed and statistically significantly. Furthermore, it is statistically significantly different from zero in a Wald test, indicating that the two outcomes are related and that there are some unobservable factors which are positively related to both dependent variables.

The results of the estimation of the bivariate probit of *notraining* and *skillsgap* are reported in Table 10. The signs of each variable are the same in both the two corresponding binomial probit estimations and the bivariate probit estimation. Further, the size of each coefficient and their respective 'P>|z|' values are very similar. The value of rho is estimated at - 0.13. It statistically significantl. Further, it is statistically significantly different from zero in a Wald test, indicating that the two outcomes are related. However, in this instance, it is negatively signed, denoting that

the unobservable factors in question are negatively related to one of the dependent variables and positively related to the other and *vice versa*.

Finally, the results of the estimation of the bivariate probit of *notraining* and *hardtofill* are reported in Table 11. Again, the signs of each variable are the same in both the corresponding binomial probit estimations and the bivariate probit estimation. The magnitude of each coefficient and their respective 'P>|z|' values are also very similar. The value of rho is estimated at 0.05. The result is not statistically significant. Further, it is not statistically significantly different from zero in a Wald test. There is no statistical evidence, therefore, of a relationship between these two establishment outcomes.

Two relationships are identified in the three bivariate probit estimations: one between the incidence at the establishment of hard to fill vacancies and of skills gaps; and the other between the incidence at the establishment of skills gaps and no training taking place. However, whereas the nature of the relationship between the two dependent variables in the first instance is positive, the nature of the relationship between the two dependent variables in the second instance is negative. Furthermore, whereas the determinants of the incidences of hard to fill vacancies and skills gaps are sometimes quite similar, although with the important differences noted above, the determinants of the incidence of skills gaps and no training are quite different, most notably with reference to the contrasting impacts of establishment size on the two dependent variables.

6. CONCLUSIONS

This paper had two aims. The first was to identify the determinants of the incidence at establishment level of three outcomes viz. skills gaps, hard to fill vacancies and no training taking place. This was done to ascertain the extent to which the determinants of the three variables were similar. This part of the investigation made use of a binomial probit model. The second aim of the paper was to examine whether combinations of the three establishment outcomes in question were related. This part of the investigation made use of a bivariate probit model. The analysis made use of the establishment based Scottish Employers' Skills Survey of 2008, the fifth in a series of large scale surveys undertaken to obtain employers' perspectives on a

diverse range of skills related issues e.g. vacancies, including hard to fill vacancies, skill shortages, skill gaps and training.

The observed determinants of the three establishment level outcomes were seen to be quite different. Skills gaps were relatively more likely to be found in establishments in the private sector; in establishments at which an element of the training undertaken was done to meet legal requirements; in establishments which had a training plan; which had recently changed their methods of working; and which had recently changed their senior management. By contrast, skills gaps were relatively less likely in the smaller sized establishments and establishments which made extensive use of highly skilled labour. Hard to fill vacancies were relatively more likely in larger sized establishments; in establishments in the private sector; and in establishments which made use of part time and temporary staff. By contrast, hard to fill vacancies were relatively less likely in the smaller sized establishments. No training was relatively more likely in the two smallest sized establishments; in establishments which were in the private sector; and which were single plant enterprises. By contrast, no training was relatively less likely in establishments which had an element of their training required to meet legal conditions; which employed a highly skilled workforce; which employed workers on temporary contracts; and which had a training plan. That said, there was some similarity between the determinants of the incidence of skills gaps and hard to fill vacancies, and certainly more similarity between this combination of the three variables and any other combination. The most discernible similarities related to the impact of variables denoting size and sector.

Two relationships were identified in the three bivariate probit estimations: one between the incidence of hard to fill vacancies and skills gaps; and the other between the incidence of skills gaps and no training taking place. However, whereas the nature of the relationship between the two dependent variables in the first instance was positive, the nature of the relationship between the two dependent variables in the second instance was negative.

Given the manner in which the bivariate probit model controlled for observable variables denoting geography, size and sector, it is legitimate to speculate that a possible source of the unobservable variables identifying the two relationships may be

variables associated with policy (perhaps more especially human resource management policy) in operation at the workplace and/or the process used. For example, it is possible to conceive of establishment situations at which an ineffective, perhaps re-active, recruitment policy would be positively correlated with hard to fill vacancies and skills shortages. Equally, it is possible to conceive of establishment situations associated with the employment of highly skilled labour, perhaps using advanced technology at which no training is unlikely yet skills gaps possible.

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Table 1. The Dependent and Independent Variables in the Estimations: Names, Descriptors and Origins

Name	Descriptor	Origin
The Dependent Variables		
Skillsgap	There are 'skills gaps' prevalent in the establishment (=1)	From GAP_ANY in the codebook
Hardtofill	Some vacancies in the establishment are 'hard to fill' (=1)	From H2F_ANY in the codebook
notraining	Whether no training of any sort has been undertaken in the past 12 months (=1)	Recoding of the variable TR_STAT in the codebook
The Independent Variables		
Ksmanu	Sector Skills Council Key Group (SSCKG): Manufacturing (=1)	From SSCGRP in the codebook
Ksfood	SSCKG: Food/Clothing/Wholesale/Retail (=1)	From SSCGRP in the codebook
Kshi_tec	SSCKG: Hi-technology/Business Services (=1)	From SSCGRP in the codebook
publicservices	SSCKG: Public Services – the reference category (=1)	From SSCGRP in the codebook
Kshosp	SSCKG: Hospitality/Recreation (=1)	From SSCGRP in the codebook
Kstrans	SSCKG: Transport/Construction/Utilities (=1)	From SSCGRP in the codebook
Sizecat1	Employing between 1 – 4 (=1)	From Q5SIZE in the codebook
Sizecat2	Employing between 5 -9 (=1)	From Q5SIZE in the codebook
Sizecat3	Employing between 10 – 24 (=1)	From Q5SIZE in the codebook
Sizecat4	Employing between 25 – 49, the reference category (=1)	From Q5SIZE in the codebook
Sizecat5	Employing between 50 – 249 (=1)	From Q5SIZE in the codebook
Sizecat6	Employing 250 or over (=1)	From Q5SIZE in the codebook
Private	The establishment is in the private or commercial sector (=1)	From Q9 in the codebook
Public	The establishment is in the public sector, the reference category (=1)	From Q9 in the codebook
Voluntary	The establishment is in the voluntary sector (=1)	From Q9 in the codebook
Single	The establishment is a single plant organisation (=1)	From Q11 in the codebook

Table 1. (cont.)

Name	Descriptor	Origin
Trainlaw	Some element of the training provided is required by law (=1)	From Q73 in the codebook, where the original responses 1/2/3/ are recoded = 1
Unionrec	The "organisation" (sic) recognises trade unions for bargaining purposes (=1)	From Q77 in the codebook
Highskill	The workforce at the establishment is considered to be 'highly skilled', relative to others in the industry (=1)	From Q81G in the codebook, where the original responses 4/5 are recoded = 1
Parttime	The establishment makes use of part time staff (=1)	From Q87D in the data set
Temps	The establishment makes use of temporary staff (=1)	From Q87E in the data set
Itgood	The establishment would claim that its IT systems are "state of the art", relative to others in the industry (=1)	From Q81D in the codebook, where the original responses 4/5 are recoded = 1
Trainplan	The establishment has a staff training plan (=1)	From Q85B in the codebook
Involve	The establishment has arrangements for the direct involvement of employees in decision-making and problem solving (=1)	From Q87A in the codebook
Equality	The establishment has an explicit policy on equality/diversity at the workplace (=1)	From Q87F in the codebook
Equipment	The establishment has introduced major equipment over the past 12 months (=1)	From Q83C in the codebook
Methods	The establishment has introduced major changes in working methods/workforce organisation over the past 12 months (=1)	From Q83D in the codebook
Senior	The establishment has had a change in senior management over the past 12 months (=1)	From Q83E in the codebook

Footnote to Table 1.:

Additionally, each estimation contains 10 dummy variables (plus a reference category) identifying the 11 Scottish Further Education Funding Council areas. These results are not reported in the tables which follow.

Table 2. Frequency Counts: Whether Hard to Fill Vacancies Exist, by Whether Skills Gaps Exist

	No Skills Gaps	Skills Gaps Exist	Total
No Hard to Fill Vacancies	3,371	1,477	4,848
Some Vacancies are 'Hard to Fill'	350	437	787
Total	3,721	1,914	5,635

Pearson chi-squared (1) = 189.5970 : Pr = 0.0000

Table 3. Frequency Counts: Whether a Skills Gap Exists by Whether Training is Not Done

	No Training Is Done	Training is Done	Total
No Skills Gaps	1,636	2,085	3,721
Skills Gaps Exist	501	1,413	1,914
Total	2,137	3,498	5,635

Pearson chi-squared (1) = 169.9332 : Pr = 0.0000

Table 4. Frequency Counts: Whether Hard to Fill Vacancies Exist by Whether Training is Not Done

	No Training Is Done	Training is Done	Total
No Hard to Fill Vacancies	1,926	2,922	4,848
Some Vacancies are 'Hard to Fill'	211	576	787
Total	2,137	3,498	5,635

Pearson chi-squared (1) = 47.9881 : Pr = 0.0000

Table 5. Pair Wise Correlations: hardtofill, skillsgaps and notraining

	hardtofill	skillsgaps	Notraining
Hardtofill	1.0000		
Skillsgaps	0.1834 (0.0000)	1.0000	
Notraining	-0.0923 (0.0000)	-0.1737 (0.0000)	1.0000

Table 6. Probit Results: Dependent Variable: skillsgap

Variable	coefficient	Robust Standard Error	P > |t|	Marginal Effect
Ksmanu	.1319	.1153	.253	.033
Ksfood	-.035	.1051	.734	-.008
Kshi_tec	-.0560	.0985	.569	-.013
Kshosp	-.0927	.1126	.410	-.022
Kstrans	-.1545	.1007	.125	-.036
Sizecat1	-1.1849	.0902	.000	-.311
Sizecat2	-.6294	.0710	.000	-.125
Sizecat3	-.2149	.0660	.001	-.048
Sizecat5	.1364	.0916	.137	.035
Sizecat6	.0434	.1763	.805	.010
Private	.3118	.0878	.000	.068
Voluntary	.1066	.1278	.404	.027
Single	.0905	.0588	.124	.022
Trainlaw	.1452	.0651	.026	.036
Unionrec	-.0545	.0715	.446	-.013
Highskill	-.3720	.0616	.000	-.097
Parttime	.1068	.0683	.118	.025
Temps	.0985	.0610	.107	.024
Itgood	-.0953	.0544	.080	-.023
Trainplan	.1780	.0714	.013	.043
Involve	-.0758	.0795	.341	-.019
Equality	.0118	.0698	.865	.002
Equipment	.0092	.0621	.881	.002
Methods	.2257	.0710	.001	.058
Senior	.1233	.0598	.039	.031
Constant	-.5063	.1868	.007	
Log pseudo loglikelihood				-2361.5912
Number of observations				5635
Wald chi2 (35)				669.42
Prob > chi2				0.0000
Pseudo R2				0.1649

Footnote to Tables 6, 7 and 8:
1. Marginal effects are calculated at mean values. For dummy variables they are for discrete changes from 0 to 1.

Table 7. Probit Results: Dependent Variable: hardtofill

Variable	coefficient	Robust Standard Error	P > |t|	Marginal Effect
Ksmanu	.2030	.1334	.128	.033
Ksfood	-.1571	.1283	.221	-.021
Kshi_tec	-.0446	.1087	.681	-.006
Kshosp	.0603	.1267	.634	.009
Kstrans	-.1713	.1203	.154	-.023
Sizecat1	-.6429	.1081	.000	-.102
Sizecat2	-.4594	.0877	.000	-.055
Sizecat3	-.1781	.0834	.033	-.024
Sizecat5	.3266	.0974	.001	.059
Sizecat6	.5843	.1685	.001	.124
Private	.4911	.1112	.000	.057
Voluntary	.0218	.1484	.883	.003
Single	-.0009	.0971	.992	-.000
Trainlaw	-.0869	.0747	.245	-.012
Unionrec	-.0368	.0930	.692	-.005
Highskill	-.0624	.0808	.439	-.009
Parttime	.3214	.0938	.001	.044
Temps	.2674	.0820	.001	.041
Itgood	-.0172	.0787	.827	-.002
Trainplan	-.0939	.0967	.331	-.013
Involve	.0075	.0958	.937	.001
Equality	.0393	.0974	.686	.005
Equipment	.1283	.0794	.106	.019
Methods	.0641	.0907	.480	.009
Senior	-.0051	.0863	.953	-.000
Constant	-1.8097	.2149	.000	
Log pseudo likelihood				-1650.6352
Number of observations				5635
Wald chi2 (35)				304.36
Prob > chi2				0.0000
Pseudo R2				0.1012

Table 8. Probit Results: Dependent Variable: notraining

Variable	coefficient	Robust Standard Error	P > |t|	Marginal Effect
Ksmanu	.1931	.1304	.139	.075
Ksfood	.4379	.1241	.000	.166
Kshi_tec	-.1205	.1265	.341	-.047
Kshosp	.1460	.1309	.265	.057
Kstrans	.0543	.1284	.672	.021
Sizecat1	.5974	.0953	.000	.233
Sizecat2	.2924	.0840	.000	.113
Sizecat3	-.0129	.0812	.873	-.005
Sizecat5	-.2068	.1059	.051	-.082
Sizecat6	-.4853	.3568	.174	-.190
Private	.3778	.1268	.003	.149
Voluntary	-.2121	.1711	.215	-.084
Single	.2615	.0712	.000	.103
Trainlaw	-1.0461	.0721	.000	-.398
Unionrec	-.0846	.0871	.331	-.033
Highskill	-.1564	.0662	.018	-.061
Parttime	.1084	.0728	.136	.042
Temps	-.1369	.0646	.034	-.054
Itgood	-.0606	.0674	.369	-.023
Trainplan	-.3025	.0746	.000	-.118
Involve	-.1001	.0754	.184	-.039
Equality	-.1342	.0707	.058	-.052
Equipment	-.1104	.0698	.114	-.043
Methods	-.0871	.0728	.232	-.034
Senior	-.0919	.0723	.204	-.036
Constant	.2806	.1890	.138	
Log pseudo likelihood				-2666.7946
Number of observations				5635
Wald chi2 (35)				1082.93
Prob > chi2				0.0000
Psuedo R2				0.3133

Table 9. Bivariate Probit Results: hardtofill and skillsgap

	Coefficient	Robust Standard Error	P > |z|
Hardtofill			
Ksmanu	.2040	.1337	.127
Ksfood	-.1582	.1287	.219
Kshi_tec	-.0450	.1090	.679
Kshosp	.0529	.1271	.677
Kstrans	-.1732	.1208	.151
Sizecat1	-.6339	.1083	.000
Sizecat2	-.4530	.0880	.000
Sizecat3	-.1708	.0836	.041
Sizecat5	.3334	.0978	.001
Sizecat6	.5890	.1687	.000
Private	.5000	.1113	.000
Voluntary	.0299	.1490	.841
Single	.0016	.0973	.986
Trainlaw	-.0837	.0749	.264
Unionrec	-.0391	.0926	.672
Highskill	-.0607	.0811	.454
Parttime	.3265	.0941	.001
Temps	.2708	.0815	.001
Itgood	-.0197	.0791	.803
Trainplan	-.0913	.0969	.346
Involve	.0022	.0958	.981
Equality	.0422	.0969	.663
Equipment	.1235	.0793	.119
Methods	.0659	.0906	.466
Senior	-.0024	.0866	.978
Constant	-1.8295	.2139	.000

Table 9. (cont.)

	Coefficient	Robust Standard Error	P > |z|
Skillsgap			
Ksmanu	.1358	.1155	.240
Ksfood	-.0319	.1053	.762
Kshi_tec	-.0548	.0988	.579
Kshosp	-.0908	.1128	.421
Kstrans	-.1517	.1013	.134
Sizecat1	-1.1853	.0904	.000
Sizecat2	-.6286	.0711	.000
Sizecat3	-.2144	.0661	.001
Sizecat5	.1351	.0918	.142
Sizecat6	.0426	.1767	.809
Private	.3127	.0878	.000
Voluntary	.1077	.1279	.400
Single	.0910	.0587	.121
Trainlaw	.1446	.0654	.027
Unionrec	-.0554	.0713	.437
Highskill	-.3718	.0616	.000
Parttime	.1082	.0684	.113
Temps	.1023	.0609	.093
Itgood	-.0981	.0544	.071
Trainplan	.1821	.0712	.011
Involve	-.0781	.0795	.326
Equality	.0115	.0694	.868
Equipment	.0078	.0620	.899
Methods	.2273	.0709	.001
Senior	.1244	.0598	.038
Constant	-.5114	.1871	.006
Log pseudolikelihood			-99310.521
Number of Observations			5635
Wald Chi2 (70)			985.63
Prob > chi2			0.0000
/athrho	.1723	.0466	.000
Rho	.1706	.0452	

Wald test of rho = 0 : chi2 (1) = 13.6614 : prob > chi2 = 0.0002

Table 10. Bivariate Probit Results: notraining and skillsgap

	Coefficient	Robust Standard Error	P > |z|
Notraining			
Ksmanu	.1858	.1300	.153
Ksfood	.4295	.1238	.001
Kshi_tec	-.1266	.1263	.316
Kshosp	.1399	.1307	.284
Kstrans	.0490	.1280	.702
Sizecat1	.5978	.0953	.000
Sizecat2	.2938	.0838	.000
Sizecat3	-.0121	.0810	.881
Sizecat5	-.2103	.1061	.047
Sizecat6	-.4774	.3618	.187
Private	.3811	.1265	.003
Voluntary	-.2072	.1715	.227
Single	.2617	.0713	.000
Trainlaw	-1.0457	.0721	.000
Unionrec	-.0841	.0870	.334
Highskill	-.1558	.0661	.019
Parttime	.1094	.0728	.133
Temps	-.1353	.0645	.036
Itgood	-.0612	.0674	.364
Trainplan	-.3006	.0747	.000
Involve	-.1008	.0753	.181
Equality	-.1359	.0706	.054
Equipment	-.1112	.0696	.110
Methods	-.0870	.0726	.231
Senior	-.0905	.0724	.211
Constant	.2815	.1882	.135

Table 10. (cont.)

	Coefficient	Robust Standard Error	P > |z|
Skillsgap			
Ksmanu	.1303	.1156	.260
Ksfood	-.0369	.1052	.726
Kshi_tec	-.0621	.0980	.526
Kshosp	-.0934	.1120	.404
Kstrans	-.1577	.1009	.118
Sizecat1	-1.1787	.0898	.000
Sizecat2	-.6288	.0710	.000
Sizecat3	-.2129	.0657	.001
Sizecat5	.1359	.0914	.137
Sizecat6	.0430	.1750	.806
Private	.3061	.0878	.000
Voluntary	.1159	.1277	.364
Single	.0839	.0585	.151
Trainlaw	.1524	.0646	.018
Unionrec	-.0585	.0715	.413
Highskill	-.3697	.0616	.000
Parttime	.1064	.0682	.119
Temps	.0989	.0610	.105
Itgood	-.0931	.0542	.086
Trainplan	.1762	.0710	.013
Involve	-.0748	.0794	.346
Equality	.0141	.0698	.840
Equipment	.0110	.0619	.859
Methods	.2230	.0710	.002
Senior	.1217	.0597	.042
Constant	-.5039	.1866	.007
Log pseudolikelihood			-124460.68
Number of Observations			5635
Wald Chi2 (70)			1736.79
Prob > chi2			0.0000
/athrho	-.1338	.0432	.002
Rho	-.1330	.0424	

Wald test of rho = 0 : chi2 (1) = 9.5872 Prob > chi2 = 0.0020

Table 11. Bivariate Probit Results: notraining and hardtofill

	Coefficient	Robust Standard Error	P > |z|
Notraining			
Ksmanu	.1931	.1303	.138
Ksfood	.4377	.1239	.000
Kshi_tec	-.1206	.1263	.340
Kshosp	.1460	.1308	.264
Kstrans	.0544	.1282	.671
Sizecat1	.5974	.0954	.000
Sizecat2	.2921	.0839	.001
Sizecat3	-.0127	.0812	.875
Sizecat5	-.2043	.1058	.053
Sizecat6	-.4768	.3547	.179
Private	.3777	.1267	.003
Voluntary	-.2116	.1710	.216
Single	.2604	.0713	.000
Trainlaw	-1.0460	.0721	.000
Unionrec	-.0845	.0870	.331
Highskill	-.1558	.0662	.019
Parttime	.1087	.0728	.135
Temps	-.1367	.0646	.034
Itgood	-.0607	.0674	.368
Trainplan	-.3023	.0747	.000
Involve	-.1005	.0754	.183
Equality	-.1339	.0707	.058
Equipment	-.1109	.0698	.112
Methods	-.0863	.0727	.235
Senior	-.0929	.0723	.199
Constant	.2799	.1888	.138

Table 11. (cont.)

	Coefficient	Robust Standard Error	P > |z|
Hardtofill			
Ksmanu	.2014	.1333	.131
Ksfood	-.1610	.1281	.209
Kshi_tec	-.0461	.1087	.671
Kshosp	.0584	.1269	.645
Kstrans	-.1722	.1202	.152
Sizecat1	-.6454	.1078	.000
Sizecat2	-.4579	.0875	.000
Sizecat3	-.1782	.0834	.033
Sizecat5	.3274	.0973	.001
Sizecat6	.5851	.1682	.001
Private	.4919	.1112	.000
Voluntary	.0188	.1483	.899
Single	-.0012	.0970	.990
Trainlaw	-.0882	.0749	.239
Unionrec	-.0371	.0928	.689
Highskill	-.0625	.0806	.438
Parttime	.3218	.0937	.001
Temps	.2670	.0819	.001
Itgood	-.0188	.0784	.810
Trainplan	-.0944	.0965	.328
Involve	.007	.0955	.939
Equality	.0390	.0971	.688
equipment	.1292	.0792	.103
Methods	.0641	.0905	.478
Senior	-.0055	.0860	.948
Constant	-1.8067	.2148	.000
Log pseudolikelihood			-107057.46
Number of Observations			5635
Wald Chi2 (70)			1422.61
Prob > chi2			0.0000
/athrho	.0570	.0449	.205
Rho	.0569	.0448	

Wald test of rho = 0: Chi(2) = 1.6082 : Prob > chi2 = 0.2047