By Invitation

Determinants of Skill Shortages in Indian Firms: An Exploration

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Based on primary data collected from 102 firms, located in three metropolises- Mumbai, Bangalore and Hyderabad- and heterogeneous in economic activities, size and year of existence, the authors explore the phenomenon of skill shortage among Management Graduates who are employed in managerial occupation. They describe determinants of skill shortages in these firms. They elucidate that job vacancies that are hard to fill subsume in vacancies having skill shortage that is the subset of general pool of vacancies. The paper shows that a vacancy falling within skill shortage category is sensitive to the nature of vacancy, wage, year of existence and location.

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Introduction

There is ongoing concern about the shortage of workforce with particular skill as unfavorable to the growth of firms and economy at large. Moreover, information is available at the aggregate level on skills issues, rather than how these issues affect individual firms in India. Global evidence suggests that the availability of workforce with the appropriate types and levels of skills has foremost impact on the success of the firms. Limited research conducted globally suggests that "Skill shortages directly constrain production and prevent firms from meeting demands and using available inputs efficiently with consequences for lower productivity" (Haskel & Martin, 1993b).

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The measurement of skill shortages and gaps to an extent is dependent on the definition of skill shortages used. The definitions of skill shortages that are de-

rived from macroeconomic[1] and microeconomic[2] indicators indirectly restrain innovation and use of new technologies which are skill intensive. This may lead to have long term impacts on the way firms do business, in terms of their location, size, structure, production methods and product strategy[3]. Thus, exploring how these skill shortages manifest them will not only help industry to fill skill gap but also improve international competitiveness.

This paper aims to unravel our understanding of skills within Indian firms. At first this paper discusses the microeconomic measures of skill shortage and explores the determinants of skill shortages i.e. vacancies which are hard-to-fill due to skill-related reasons. Moreover, the paper tries to explore the probability that the firm had any vacancies and hard-to-fill vacancies in the last year. This paper uses two methods to investigate the determinants of a firm reporting the three types of vacancies. First, we estimated separate chances for the firm reporting each of the vacancy types. However, the mechanisms causing firms to report each of the different types of vacancies are likely to be interrelated. All skill and non-skill related shortage vacancies are by definition hard-to-fill vacancies. In addition, a proportion of firms have vacancies while other firms do not have vacancies so it is important to account for the factors which influence the reason firms recruit as opposed to those which do not.

Skill Shortage - An Overview

It is surprising that mainstream economic theories have not contributed significantly on the issues of skill and tends to work with open concepts of labor supply and demand. Applied labor market research has advanced on general accepted understanding of 'skill' which means the ability to execute specified tasks. However, classifications of skill dimensions are based on particular tasks and level of ability (training) needed. The very notion of a skill shortage can be helpful because of its broad perspective but it may not match-up with the employers' explanation.

Besides, previous research has pointed out ambiguities over both the notion of 'skills' and of 'shortage'. It is often apprehended that the 'skills' are being referred as technical, defined by the ability to perform given tasks or to master various techniques, whether manual or cognitive. The study conducted by Oliver & Turton (1982) explores what employers mean by skills (when they refer to skills shortages) encompassing also a range of behavioral attributes such as reliability, ability to work without supervision and stability of employment. Bosworth, Dutton & Lewis (1992) recognize both behavioral attributes and technical skills which are included in the potential list of qualities that employers are looking for.

[1] For example, an excess of demand over supply for labor draws on macro measures such as vacancy rates.

[2] For example, percentage of establishments reporting skill shortages will necessarily draw on micro measures such as employer surveys.

[3] See Durbin (2004), Mason &Wilson (2003)

The global concern regarding skills shortages has 'become more acute…in the new millennium' (Cohen & Zaidi, 2002:1). India shares the same concern. In the research titled 'Global Skill Shortages', Cohen & Zaidi (2002:1) argue that the world is heading into 'new periods of skill shortages in the 21st century'. Indian newspaper reports echoes this concern about current skills shortages and the negative impact this might have on local economic expansion. A number of Indian companies had been experiencing a significant shortage of skilled and competent personnel which has increased in recent years. This is in direct contrast with the recent economic expansion in India. Companies are anxious that this will place Indian firms at a disadvantage when they compete with international business groups.

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Indian press reports in recent years like "India: Desperately Seeking Talent"[4] shows the ongoing shortage of skilled professionals, echoing concerns expressed at the various levels of the supply and demand mismatch in the country. Public debate over the nature of the skill shortage in India is central to questions of sustainability of current and future economic expansion. While many industries are having trouble finding the right employees, they have so far managed by hiring less-skilled employees and training them.

Organizations in India operate in a highly competitive local and/or global economic environment. Their competitiveness is compromised by the shortage of skilled professionals in the local labor market. The skills shortage in India is resulting in serious cost implications for organizations causing major delays and cost overruns. An examination of the relationship between local and global skill shortages to that of supply and demand provides an opportunity to identify the specific problem(s) and ultimately find the solution to this complex issue.

In the world of empirical work, shortages have always been interpreted or even defined directly in terms of difficulties in filling vacancies or job. The empirical work of Haskel & Martin (1993a) treated the CBI[5] skills shortage as an indicator, a proxy for the average duration of vacancies of skilled labor &Stevens (1994) uses the same indicator as a proxy for the marginal cost of recruiting skilled labor. Haskel & Martin (1993b) and Bosworth (1993) measure skills shortage in various ways directly as a hard-to-fill vacancy.

[4]Asian Business, http://www.businessweek.com, November 7, 2005

[5]CBI conducts survey of senior manufacturing executives on trends in output, prices, exports, and costs. The CBI Industrial Trends Survey collects data on topics like current business confidence, capacity utilization and investment intentions. The survey differs from most other economic surveys in that it focuses on the opinions of executives rather than quantitative data.

There has been limited research which focuses on the determinants of vacancies. Undoubtedly research is being impacted by dearth of data on vacancies and vacancy rates. In this paper, an important objective is to explore the determinants of vacancies at the firm's level. The discourse here is most closely related to Holzer (1994) in that the concern here is with both vacancy incidence and vacancy rates. However, in distinguishing between the various types of vacancies (hard-to-fill and skill-shortage vacancies in particular), there are clear parallels with the recent work of Haskel & Martin (2001) who utilize 1991 Employee Manpower and Skills Practices Survey (EMSPS)

The determinants of skill mismatch are both cyclical and structural.

The determinants of skill mismatch are both cyclical and structural. On the one hand, skill mismatch has been found to be pro-cyclical with recessions causing firms to separate from the matches with the lowest productivity.[6] On the other hand, some structural changes – such as the adoption of new technology – require skills that are not immediately available in the labor market. While education/vocational systems adapt to these new skill requirements, firms experience skill gaps between their employees' skills and those required by the jobs they fill.[7] Also, the institutional framework regulating the labor market will influence the speed at which firms are able to adapt to structural change.

Firms may also view labor shortages as internal skill deficiencies (where the skills of their existing workforce are below some optimal level), or skill gaps (where firms' existing workers lack sufficient skills to perform their jobs effectively). Moreover, Oliver & Turton (1982) point out those firms may identify as important requirement to cope with non-routine technical problems, to work with little or no supervision or to have speed on the job and be reliable. However, these are different in their implications from skill shortages, although they are often conflated in practice (Shah & Burke, 2005). Interestingly, hiring standards are adjusted according to the country of the labor market. When demand is high, employers may be forced to take on workers who lack experience, qualification and other desired personal attributes. In contrast, when demand is low and labor is abundant, firms may raise their expectations and look for qualities beyond those required in terms of the technical capacity to perform the job (Richardson, 2007). This further explains that in tight labor markets the number of under-educated and under-skilled workers is likely to increase, while in slack labor markets the number of over-educated or over-skilled workers is likely to do likewise. These imbalances have implications for the chance of both internal and exter-

[6] Olitsky (2008) finds that the proportion of unskilled workers in skilled jobs and the overall proportion of mismatches are negatively correlated with the unemployment rate in the United States.

[7] In addition to generating skill shortages and skill deficits, technological change has also been linked to over-qualification and under-qualification, although through a somewhat different mechanism.

nal training being offered as a response to balance the imbalances. Therefore hiring standards may vary, according to different stage of the business cycle.

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Very few empirical works looked at the determinants of skill mismatch, mostly because of the difficulty in identifying and/ or collecting data on a suitable cross-country longitudinal measure of mismatch as dependent variable. A few researchers who have approached the task have looked at measures of matching inefficiency, derived from the job search and matching literature. Marsden et al (2002) explore the effect of demand, supply and institutional factors in European countries using the indicator developed by Layard et al (1991) which consists of the variance of skill specific unemployment rates.[8]

In the work by Marsden et al. (2002), technological progress, measured as expenditure in R&D, is not found to affect skills mismatch. On the other hand, Haskel & Martin (2001) use UK firm-level data and find that skills deficiencies are significantly higher for high-tech firms.[9] Similarly, Robson (2006) explores the effect of structural change[10] on the efficiency of matching in UK regions exploiting the index of sectoral shifts developed by Lilien (1982).[11] His work put forward that an increase in sectoral shifts may lead to an increase in the degree of mismatch between the skills possessed by on-the-job searchers and the skill requirements of local employers. Robson (2006) also explored the role of the degree of specialization in regional employment in the efficiency of the matching process but found no evidence to support the expected positive effect.

The significance of present data source for the study is first that respondents representing firms were asked in exclusively separate questions about :(a) Do you currently have any vacancies for management graduates either full or part time staff? (b) Are any of these vacancies providing difficulty to fill with suitable applicants? (c) For which of the following reasons did this business find it hard-to-fill vacancies of their existing workforce? By corresponding to their responses to these separate questions the study was able to gain valuable insights in to firms' sensitivity of skills shortage. The study also tried to explore the factors which are fundamental to these three experiences in order to throw further light on their similarities and differences.

[8] This indicator is ½var (ui/u), where ui is the unemployment rate relative to the i th skill group and u is the national unemployment rate.

[9] The variable used by Haskel & Martin (2001) is constructed based on the question: "would you say that this establishment has experienced a skill shortage?", hence, the answers could reflect either skill deficiencies in the existing workforce or difficulties in hiring new workers.

[10] New technologies are often accompanied by structural change.

[11] Lilien's index is a weighted standard deviation of sectoral employment growth relative to aggregate emplayment growth.

Data Sources &Methodology

This study is exploratory in nature and makes use of descriptive framework of analysis. Understanding skill shortage among Management Graduates is the focus of the study. The units of analysis are firms in India who hire management graduates at both global and local levels. The list of firms was identified through the Captiline Database[12]. An uneven distribution of firms across the country led to choose different locations for the study. Based on the proximity and total number of firms, the study decided to choose Mumbai, Bangalore and Hyderabad for sample selection. The three cities were seen as different groups to allow proportional representation of enterprises across. After grouping, random method was employed in selecting the companies to avoid researcher's biases in the selection. The statistically acceptable sample size was determined by employing Daniel (1999)[13] to justify the responsive sample size of the survey. To increase the response rate an online version of the survey was prepared. Each schedule includes a letter of introduction and a schedule. Subsequently 102 interview schedules[14] were completed, majority of which were administered by face-to-face interviews. A total of 76 (74.5%) were administered by face-to-face interviews and 26 (25.5%) by online survey form.

The study is exploratory in nature and makes use of descriptive framework of analysis. Skill shortage among Management Graduates is the focus of the study. The unit of analysis is firm. In the study, we have used four methods for analyzing quantitative data: Bivariate Analysis, Chi Square and Bayesian Conditional Probability. The general characteristics of sample firms are present in Appendix 1.

Skill Shortage Indicators

Indicators for skill shortages draw on primary research with firms to determine the extent and nature of skill shortages

[12] Capitaline Database which covers more than 22,000 Indian listed and unlisted companies, classified under more than 300 industries, along with powerful analytic tools.

[13] To calculate an appropriate sample size, we apply the following formulae: $n = \frac{NZ^2(1-P)}{d^2(N-1)+Z^2(N-1)}$ where *n* delineates sample size drawing from the finite population (*N*), *Z* represents Z statistic for 95% confidence level, *P* is the expected proportion that we are going to calculate, *d* indicates precision (Daniel, 1999). It should be noted that the Z value is set at 1.96 for 95% confidence level. Interestingly, *P* (expected proportion) varies between 0 and 1, and the sample size is a variant of *P*. It is important to note that the P is taken in proportion of one, i.e., if expected proportion or prevalence is 40%, then *P* is equal to 0.4. Smaller *d* implies good precision or smaller error of estimate, and it should be in proportion of one (Naing et al,. 2006). Interestingly, although there is no precise rule to choose an appropriate d, Naing et al (2006) show that if P is less than 10% (0.1), then *d* should be half of *P*, i.e., 0.05. On the other hand, if P is greater than 90% (0.9), *d* would be 0.5 (1-P). Of course, a larger or smaller d can be set depending on the availability resources. If P is between 0.1 and 0.9, then it is appropriate to choose 5% precision (0.5). In this study, P=0.5 and d=0.1., the sample size is 96.

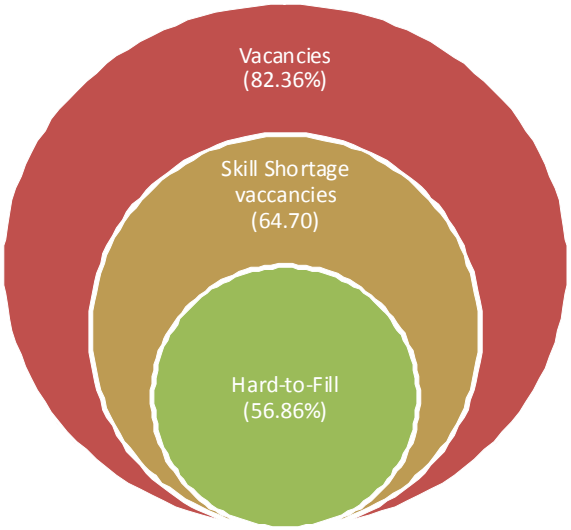
[14] For face-to-face interview, interview schedule was used and parallel to schedule, an online tool was developed.

faced in an industry or firms. It also provides an indicator of employer-specific skill shortages. Micro measures have the advantage over macro measures in addressing the issues of skill shortages directly where macro measures relay on proxy measures. However, there are a number of potential issues associated with employer surveys.

Haskel & Martin (2001) illustrate the direct approach taken by employer surveys in measuring skill shortages. They attempted to measure shortages through the following questions. Skills shortages: "Would you say this firm has experienced a 'skills shortage' in the last 12 months or not?" Hard-to-fill vacancies: "Do you currently have vacancies that are proving to be hard-to-fill?" Hiring difficulties: "How easily have you been able to fill vacancies in each of the occupational groups in the last 12 months?"

The study by Green &Owen (2003) uses an analogous range of micro indicators to measure skill shortages. The study uses a wide range of measures that address criticisms of purely vacancy-based measures as noted by Green, Machin & Wilkinson (1998). Green & Owen (2003) used the following: firms reporting all vacancies; firms reporting hard-to-fill vacancies; firms reporting skill shortage vacancies; the percentage of firms reporting skill gaps. The present study adopted the approach from Haskel & Martin (2001) to explore and measure the skill shortage among management graduates in Indian firms. The overall percentage of firms reporting each type of vacancy is depicted in Fig. 1. Details on the structure and patterns of the measures of vacancies, hard-to-fill vacancies and skill shortage vacancies are discussed in the forthcoming sections.

Fig. 1 Vacancies, Hard-to-Fill &Skill Shortage Vacancies (n*=102)



Source: Field Survey carried in Hyderabad, Bangalore and Mumbai in 2012
Note: Figure shows the percentage of Firms that reports each type of vacancy.
*n =total number of sample firms

Shortages by Hard-to-fill Vacancy

The central argument surrounding the use of vacancies is that hard-to-fill vacancies (HTFVs) are parallel to skill shortages as hard-to-fill vacancies represent the inability of employers to fill vacant jobs. For example, Haskel and Martin (1993) used measures relating skill shortages to vacancy duration and argue that skill shortages cor-

respond towards hard-to-fill vacancies. In contrast, Green, Machin &Wilkinson (1998) argue that skill shortages cannot be equated with hard-to-fill vacancies. The argument was that employers view skill shortages as a wider problem, including internal skill gaps. The study reported a substantial but incomplete overlap between skill shortages and hard-to-fill vacancies, questioning the use of hard-to-fill vacancies as a reliable measure.

Skill shortages cannot be equated with hard-to-fill vacancies.

In the present study, participants were asked: 'are any of these vacancies providing difficult to fill with suitable applicants?' Those whom answered 'yes' to this question were classified as having a hard-to-fill vacancy represented at the bottom of Table 1. It was found that more than half of the firms has vacancies which are hard-to-fill (56.86% compared to 82.4%). It was also found that the probability of having skill shortage increases if firms are having hard-to-fill vacancy increases with firm size. Table 1 presents the association between skill shortages with respect to hard-to-fill vacancy. 57 per cent of the firms are facing hard-to-fill vacancies in which around 43 per cent of the firms are having skill shortage. On the other hand, 43 per cent of the firms don't have hard-to-fill vacancies in which 21.56 per cent having skill shortage and 21.56 per cent are not having skill shortage.

Table 1: Association between Skill Shortages and Hard-to-Fill Vacancy (n*=102)

	Hard-to-fill vacancies (%)		
Skill Shortage	Yes	No	Total (%)
With Skill Shortage	43.13	21.56	64.70
Without Skill Shortage	13.72	21.56	35.30
Total	56.86	43.13	100

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai in 2012
Significance level by chi-square test (p = .007)
*n = total number of sample firms

Skill Shortages by Wage Rates

It is important to be aware of the distinction between efficiency-enhancing wage rises and deleterious wage rises. Surprisingly both types of wage growth are not in the interests of the economy. One of the very simple ways to overcome a skill shortage in the short-run is to offer higher wages to attract existing skilled workforce. Shah & Burke (2005) listed a number of potential indicators of shortages including vacancy rates, unemployment rates, wages, employer surveys of recruitment difficulties and measures of overtime hours worked.

Table 2 shows the association between skill shortages by wage rates. 37 per cent of the firm's wages are above average where 13 per cent are of those firms who are having skill shortage and 24 per cent without skill shortage. Inter-

estingly, 65 per cent of the firms are having skill shortage which provides above average and average wage to the workforce.

Table 2: Association between Skill Shortages and Wage Rates (n*=102)

	Wage Rates (%)		
Skill Shortage	Above Average	Average	Total (%)
With Skill Shortage	12.74	51.96	64.70
Without Skill Shortage	24.50	10.78	35.30
Total	37.25	62.75	100

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai in 2012
Significance level by chi-square test (p = .000)
*n = total number of sample firms

Skill Shortage by Year of Existence

Table 3 shows the association between skill shortage and year of existence. As the existence of firm increases skill shortages among these firms increase. Since the workforce within the firm did not go under training their skills were not upgraded. 65 per cent of the firms are having skills shortages and around 35 per cent of the firms are without skills shortages.

Table 3: Association between Skill Shortage & Year of Existence (n*=102)

	Skill ShortageYear of Existence (%)				
	0 – 5	6 - 10	11 – 15	15+	Total (%)
With Skill Shortage	10.78	9.80	16.67	27.45	64.71
Without Skill Shortage	4.90	12.75	2.94	14.71	35.29
Total	15.69	22.55	19.61	42.16	100

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai in 2012
Significance level by chi-square test (p = .041)
*n = total number of sample firms

Skill Shortages by Location

Regional firm that develop and deliver a work life balance employer brand will play an important role in attracting and retaining workers to areas facing skill shortages.

It is widely acknowledged that a complex range of factors explains flexibility and mobility of workers when faced with the prospect of relocating to a regional location (Canterford, 2006). The two interconnected factors are the relocating worker's desire to advance his lifestyle and to enjoy a better work life balance. The first factor is related to the lifestyle appeal of the location. This destination based approach relates to factors often associated with the improved lifestyle offering of a location (Salt, 2001). The second factor relates to the condition of employers to offer

work and pay conditions that will enable the relocating worker to actually enjoy the lifestyle factors. To these ends, regional firm that develop and deliver a work life balance employer brand will play an important role in attracting and retaining workers to areas facing skill shortages. Table 4 shows the association between skill shortages and location of the firm. It is evident from the table that 65 per cent of the firms (22.55 per cent in Mumbai 22.55 per cent in Hyderabad and 19.61 per cent in Bangalore) have skill shortage. 35 per cent of the firms (14.71 per cent, in Mumbai 25.49 per cent in Hyderabad and 17.65 per cent in Bangalore) do not have skill shortage.

Table 4 Association between Skill Shortages and Location (n*=102)

Skill Shortage	Location (%) Mumbai	Hyderabad	Bangalore	Total (%)
With Skill Shortage	22.55	22.55	19.61	64.71
Without Skill Shortage	14.71	2.94	17.65	35.29
Total	37.25	25.49	37.25	100.00

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai in 2012
Significance level by chi-square test (p = .010)
*n = total number of sample firms

Skill Shortage: Dimensions & Determinants

The low number of unemployment and high number of vacancies can lead us to skill shortages

In empirical and literature work, vacancy proposition appears to be well-regarded as measures of skill shortages. The incidence of any vacancies relating to unemployment (V/U) or employment (V/E), vacancy proposition across occupations and vacancy hiring rate relating to unemployment or employment can be seen as good measures of the gravity of skill shortages. The low number of unemployment and high number of vacancies can lead us to skill shortages and a high number of vacancies with a high number of unemployment may indicate some type of labor market mismatch, probably skill shortages but possibly employer-related.

In the present study, participants that had hard-to-fill vacancies were asked 'what are the main reasons that the vacancy is providing hard-to-fill?' They were given seventeen categories from which they could choose as many as they wished. Those replied 'applicants lack the work experience the company demands' or 'applicants lack the qualifications or skills the company demands' were defined as having skill shortage vacancies (SSVs). 64.70 per cent firms said that there is a gap between the type of skills that currently employees have and those that firms need to meet its business objectives.

One of the significant points within the labor markets irrespective of macroeconomic condition existing is that most

of the firms have vacancies at one point in time as employees quit voluntarily (MacKay & Jones, 1989). For instance, based on 5500 firms in New Zealand, Mason et al. (2010) observed that 76.6 per cent of the firms had vacancies, 47.9 per cent hard-to-fill vacancies and 35.7 per cent skill shortage vacancies during last year. However, the corresponding figure for the present study is 82.36 per cent of the firms had vacancies, 56.86 per cent hard-to-fill vacancies and 64.7 per cent skill shortage vacancies last year. It would be interesting to address two important questions: first, what factors determine firms' skill shortage; second, does the degree of skill shortage vary across different set of firms. A major point which can be emphasized in describing the determinants of skill shortage is the vacancy and hard-to-fill vacancy. Indeed, the association of vacancy and hard-to-fill vacancy with skill shortage, to some extent, is always implicit in nature. In this framework, it would be interesting to highlight the peculiarity among size of the firms and number of years in existence. Following Pissarides & Wadsworth (1994), the study estimates the conditional probability for skill shortage with vacancy and hard-to-fill vacancy.

Bayesian Conditional Probability

Until recently, there was no difference between what we now call frequentist[15] (or traditional) and Bayesian approaches to statistical implication. Fienberg's (2006) work powers the distinction, as well as the term "Bayesian", to the work of Fisher (1925/1973; 1935/1960) in the first half of the twentieth century. The origins of Bayesian inference are much older than the terminology, and are in fact closely entwined with the early development of probability and statistics over 250 years ago. In 1763, a posthumous paper by the Reverend Thomas Bayes was presented to the Royal Society in London (Bayes ,1958). Bayes was interested in *inverse probability* – inference of probability parameters from observations of outcomes and prior beliefs. He was specifically interested in estimating the binomial parameter for the distribution of repeated Bernoulli trials from observations of outcomes. The paper proved a special case of what is now called Bayes' Theorem.

The management researcher faced with a choice between Bayesian and frequentist methods has much to consider. There has been a specific situation where Bayesian analysis offers persuasive advantages. Bayesian methods that treat probability as a measure of uncertainty may be a more natural approach to some high-impact management decisions, such

[15]As suggested by Bayarri &Berger (2004), in general, frequentist methods are computationally relatively simple and no need for numerical integration. In many cases the frequentist and Bayesian interpretations are different: Bayesian methods are based on decision theoretic principles; actions are dictated by risk management by minimizing the expected loss under a chosen 'loss' function. Similar choices are needed in frequentist methodology to determine the optimal procedure (e.g. least squares or maximum likelihood estimation).

as strategy formation, portfolio management, and decisions whether or not to enter risky markets. For such decisions, concepts from large-sample statistics such as asymptotic distributions and the law of large numbers are largely irrelevant. In such situations, a subjective mindset is natural and practical (Agresti & Hitchcock 2005).

The Bayesian approach to statistical implication is a fundamentally different paradigm than the traditional frequentist approach. The Bayesian interpretation of probability as a measure of certainty is quite unlike the frequentist interpretation as a measure of chance. Bivariate Bayesian conditional probability and odds ratios are used to illustrate skill shortage vacancy and hard-to-fill vacancy. Table 5 shows the skill shortage by vacancies in firms among management graduates who had vacancies or had not any vacancies. Table 6 shows the skill shortage by hard-to-fill vacancies among management graduates who had witnessed hard-to-fill vacancies or who had not witnessed hard-to-fill vacancies. Based on the results presented in table 7 and 8, it stipulates probabilities for these two categories.

Table 5 Skill Shortage by Vacancies in Firms (n*=102)

Skill Shortage	Firm with Vacancies	Firm without Vacancies	Total
Yes	54	12	66
No	30	6	36
Sample size (n)	84	18	102

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai, 2012
*n = total number of sample firms

Table 6 Skill Shortage by Hard-to-fill Vacancies (n*=102)

Skill Shortage	Firm with Hard-to- fill Vacancies	Firm without Hard-to-fill Vacancies	Total
Yes	44	22	66
No	14	22	36
Sample size (n)	58	44	102

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai, 2012
*n = total number of sample firms

As shown in table 7, the probability of having skill shortage if firms have vacancies is 0.64, while the probability of having skill shortage if firms do not have vacancies is 0.67. What is striking is that the probability of having vacancies in firms if firms report skill shortage is 0.82 and the probability of having vacancies in firms if they are not having skill shortage is 0.83. Similarly, the probability of no skill shortage if firms have vacancies is 0.36, whereas the probability of no skill shortage if firms do not have vacancies is 0.33. The probability of not having vacancies in firms if firms have skill shortage is 0.18, whereas the probability of not having vacancies in firms if firms do not have skill shortage is 0.17.

Table 7 Bayesian Conditional Probability for Skill Shortage and Vacancies

P (A)	The probability that the firms are likely to connect with skill shortage	0.65
P (~A)	The probability that the firms are unlikely to connect with skill shortage	0.35
P (A/B)[1]	The probability of having skill shortage *(A)* if firms having vacancies (*B*)	0.64
P (A/ ~B)	The probability of having skill shortage *(A)* if firms not having vacancies (~*B*)	0.67
P (~A/B)	The probability of no skill shortage (~*A*) if firms having vacancies (*B*)	0.36
P(~A/ ~B)	The probability of no skill shortage (~*A*) if firms not having vacancies (~*B*)	0.33
P (B)	The probability that the firms are likely to connect with having vacancies	0.82
P (~B)	The probability that the firms are likely to connect with not having vacancies	0.17
P (B/A)	The probability of having vacancies in firms (*B*) if firms are connected with skill shortage*(A)*	0.82
P (B/ ~A)	The probability of having vacancies in firms (*B*) if firms are not connected with skill shortage (~*A*)	0.83
P (~B/A)	The probability of not having vacancies in firms (~*B*) if firms having skill shortage (*A*)	0.18
P(~B/ ~A)	The probability of not having vacancies in firms (~*B*) if firms not having skill shortage (~*A*)	0.17
Odds ratio	*P (A/B)/ P (~A / B) =1.77; P (A/ ~B)/ P (~A / ~B) = 2.03;P (B /A)/ P (~B /A) = .11; P (B / ~A)/ P (~B / ~A) =*	*.4.88*

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai, 2012

As shown in table 8, the probability of having skill shortage if firms have hard-to-fill vacancies is 0.76, while the probability of having skill shortage if firms have hard-to-fill vacancies is 0.50. What is striking is that the probability of having hard-to-fill vacancies in firms if establishment reports skill shortage is 0.67 and the probability of having hard-to-fill vacancies in firms if firms are not having skill shortage is 0.39. Similarly, the probability of no skill shortage if firms have hard-to-fill vacancies is 0.24, whereas the probability of no skill shortage if firms do not have hard-to-fill vacancies is 0.50. The probability of not having hard-to-fill vacancies in firms if firms have skill shortage is 0.33, whereas the probability of not having hard-to-fill vacancies in firms if firms do not have skill shortage is 0.61.

Conclusion

This paper explored the 'skill shortage' as understood by respondents representing firms. There are considerable overlaps between firms with skill shortage and hard-to-fill vacancy. Moreover, there are certain factors determining the experience of skill shortages and/or the experience of a hard-to-fill vacancy. It is also evident, that there are overlaps between firms reporting skill shortage and those reporting some deficiencies in the 'qualities' of their existing employees. The degree of overlap is not so strong as between skill shortages and hard-to-fill vacancies.

The firm experiencing skill shortage partly is likely to witness more hard-to-fill vacancies due to the deficiency in the supply of quality workforce.

Table 8 Bayesian Conditional Probability for Skill Shortage and Hard-to-fill Vacancies

P (A)	The probability that the firms are likely to connect with skill shortage	0.65
P (~A)	The probability that the firms are unlikely to connect with skill shortage	0.35
P (A/B)	The probability of having skill shortage *(A)* if firms having hard-to-fill vacancies (*B*)	0.76
P (A/ ~B)	The probability of having skill shortage *(A)* if firms not having hard-to-fill vacancies (~*B*)	0.50
P (~A/B)	The probability of no skill shortage (~*A*) if firms having hard-to-fill vacancies (*B*)	0.24
P(~A/ ~B)	The probability of no skill shortage (~*A*) if firms not having hard-to-fill vacancies (~*B*)	0.50
P (B)	The probability that the firms are likely to connect with hard-to-fill vacancies	0.57
P (~*B*)	The probability that the firms are likely to connect with not having hard-to-fill vacancies	0.43
P (B/A)	The probability of having hard-to-fill vacancies in firms (*B*) if establishment are connected with skill shortage*(A)*	0.67
P (B/ ~A)	The probability of having hard-to-fill vacancies in firms (*B*) if firms are not connected with skill shortage (~*A*)	0.39
P (~B/A)	The probability of not having hard-to-fill vacancies in firms (~*B*) if firms having skill shortage (*A*)	0.33
P(~B/ ~A)	The probability of not having hard-to-fill vacancies in firms (~*B*) if firms are not having skill shortage (~*A*)	0.61
Odds ratio	*P (A/B)/ P (~A / B) = 3.16; P (A/ ~B)/ P (~A / ~B) = 1;P (B /A)/ P (~B /A) = ; P (B / ~A)/ P (~B / ~A) =*	*2.03 0.63*

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai, 2012

The paper suggests that the firm experiencing skill shortage partly is likely to witness more hard-to-fill vacancies due to the deficiency in the supply of quality workforce. Similar finding can be observed in the work of Robinson (1996) who makes similar observations but from a more macroeconomic perspective. The analysis by Robinson seems to suggest that employers appear not to have any problem for themselves in interpreting questions on 'skills shortages' but these questions are not being perceived in a uniform way by all employers.

The two major points which are emerging from the above analysis: first, the firms have two choices, one is with skill shortage or without skill shortage. Second, vacancy has two implications: vacancy and no vacancy. This implies that if an establishment is looking for workforce then it has to choose either of these. While choosing workforce to fill vacancy implies both finding workforce with and without skill shortage, hard-to-fill vacancy merely implies lack of skill the establishment demands for a particular job, commonly happens when the workforce do not have adequate skill set to perform the job. In fact, the distinction between skill shortage and no skill shortage has received tremendous scholarly attention in the domain of labour economics. A number of studies by scholars like Haskel & Martin (1993b); Bosworth (1993) and Oliver & Turton (1982) shows in empirical work, short-

ages have always been observed and interpreted, or even defined directly, in terms of difficulties in filling vacancies or hard-to-fill vacancy.

Hard-to-fill vacancy merely implies lack of skill the establishment demands for a particular job, commonly happens when the workforce do not have adequate skill set to perform the job.

None of the studies till date has considered skills shortages in practice as encompassing problems with the skills or qualities of firms' existing employees. Firms also view labor shortages as internal skill deficiencies (where the skills of existing workforces are below optimal level) or skill gaps (where firm's workforce lacks sufficient skills to do their jobs effectively). In this context, Oliver & Turton (1982) point out to those employers who may identify as important a requirement to cope with non-routine technical problems, to work with little or no supervision or to have speed on the job and be reliable. These are different to an extent in their implications from skill shortages. Although they are often conflated in practice (Green, Machin &Wilkinson, 1998)

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Appendix 1 General Characteristics of Sample Firm (n*=102)

Characteristics	Categories	Per cent
Location	Hyderabad	24
	Bangalore	38
	Mumbai	38
Designation	Executive	34.31
	Manager	24.29
	Sr. Manager	17.64
	General Manager	10.78
	VP/Director	10.78
	Head/CEO	0.98
Industry	Pharmaceutical	2.94
	Construction	6.86
	FMCG	8.82
	Financial Services	12.74
	Management Consulting	12.74
	Others	15.68
	Information Technology	18.62
	Manufacturing	21.56
Revenue (Rs Crores)	< 100	20.6
	100 – 499	19.6
	500 – 999	17.6
	>1000	42.2
Number of Years	0 - 5	15.7
	6 -10	22.5
	11-15	19.6
	15	42.2
Size of Firm**(Employees)**	<50	7
	50 – 500	31
	500 -1000	27
	>1000	37
Per cent of Management Graduate	<10	73
	10 to 20	14
	20 to 30	7
	>30	6
Enterprises Type	Private	60
	Public (Listed)	31
	Any Other	9

Source: Field Survey carried in Hyderabad, Bangalore and Mumbai, 2012
*n = total number of sample firms