Mismatch between Skills and Jobs in Indian Labour Market During the Post-Reform Era: Estimates with Unit Level Data

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Human capital is one of the most important resources of any country which contributes to its growth. Achieving efficiency in the utilization of all important resources including human capital must be the priority of the policy makers of any country. In this context, proper matching of educated and skilled workers with the most appropriate jobs is of utmost importance. However, growing mismatch between skills and jobs in labour market during the post economic reform period has been a serious threat in India's progress towards sustainable development. Job-skill mismatch in India can be divided into two broad categories. Firstly, there is skill deficit or skill gap, where a worker's skill is not up to the requirements of the job. Secondly, there is skill underutilization (over-education or over-skilling), which arises when level of education and skill exceed those required by the job. This paper aims at a comparative analysis of job-skill mismatch in India using unit level data from the Employment and Unemployment Survey in India (schedule 10) of 50th, 61st and 68th quinquennial rounds (for 1993-94, 2004-2005 and 2011-12) conducted by the NSSO. In the beginning of our analysis, we have adopted two standard measures of job-skill mismatch, i.e. the method of standardized variance of the unemployment rate and the method of proportionality index of unemployment. Using maximum likelihood probit model, this paper tries to further explore changes in skill gap, over-education or over-skilling and downgradation of employment of workers in different occupations among several general and technical education, vocational skill, age and gender groups of India using 61st Round (2004-05) and 68th Round (2011-12) unit level employment-unemployment data of NSSO, while data of 50th Round (1993-94) could not be included due to lack of comparability. From this analysis it is evident that during the whole period of the study, people with different levels of education faced the problem of unemployment either due to lack of employment opportunities suitable for their respective levels of education or due to shortage of their skills. Under these circumstances, people with higher levels of education or skill, tried to find out such jobs which need lower levels of education or skill. Such over-crowding reduced employment opportunities for those people who had exact level of education or skill suitable for those jobs. Therefore, lack of availability of suitable jobs and decline in the opportunities to get available jobs due to over-crowding of over-educated/over-skilled people, created a double trouble for these people. As a result, they were forced to search jobs which needed lower levels of education and skill. In this way there had been a successive downgradation of employment across all the education/skill groups in India.

JEL Classification number: J08, J21, J23, J24

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1. Introduction

Human capital is a measure of the economic value of education and skill acquired by any human being. Sustainable development in any country can only be achieved through the achievement of efficiency in the utilization of all important resources including human capital. In this context, proper matching of educated and skilled workers with the most appropriate jobs is of utmost importance. Improper matching of jobs and skills leads to misallocation of resources which results in mounting social cost and appears as an impediment in the process of development. It is estimated that by 2025, 70 per cent of Indian population would be of working age, i.e. 15 to 60 years, i.e. dependency ratio would be lowest. Such a 'demographic dividend' might give India an advantage over the other developed countries which would be compelled to bear the burden of older people during the same period of time. However, growing mismatch between skills/education and jobs/occupations in Indian labour market during the post economic reform period might turn this possibility of 'demographic dividend' into a 'demographic disaster'.

According to the 68th Round Survey of NSSO, almost 68 per cent of graduates and 53 per cent post-graduates from general education background and almost 45 per cent of graduate or post-graduate degree holders and 51 per cent of graduate or post-graduate diploma holders with technical education were unemployed during 2011-12. While the problem of educated unemployed Indian youth remains acute, paradoxically, there is a shortage of skilled manpower in the labour market. While around 40 per cent of teaching positions are lying vacant in different educational institutions, we observe extremely low success rate of aspirants in different eligibility tests for the posts of teachers in schools (less than 13 per cent), colleges and universities (less than 10 per cent), organized by different government agencies like CBSE, UGC, CSIR etc. Despite a record growth in intake of engineering candidates at All India Council of Technical Education (AICTE)-approved technical institutes, more than 60% of passed out engineering graduates stay unemployed every year, according to the report of AICTE itself. The National Association of Software and Services Companies (NASSCOM) survey of 2011 claimed that over 75 per cent of technical graduates of India were not ready for jobs due to lack of desirable generic abilities. While people with higher education are found to be devoid of proper skills required for the jobs suitable for them, there are plenty of examples which reveals that

these people are increasingly applying for jobs which are suitable for people with lower levels of qualification. It is a general phenomenon in India that large number of graduates are post-graduates apply for clerical jobs which need the educational qualification of 12^{th} standard. Ironically, recently the situation has been worse in the sense that now people with Ph.D. and post-graduation degree are even applying for the jobs of peon and office bearer.[1] Hence, it is evident that lack of proper skill is creating unemployability of highly educated youth in India, as a result of which these people are trying their luck in the jobs which need lower levels of education and skill and eventually bumping out all those people who have exactly appropriate level of education and skill necessary for those jobs. Furthermore, if any over-qualified person gets a job suitable for people with lower qualification, the social cost for the years of higher education for that person becomes a dead-weight loss for the country.

Problem of job-skill mismatch in India can be divided into two broad categories. Firstly, there is education and/or skill deficit, where a worker's education and/or skill is not up to the requirements of the job. Secondly, education and/or skill underutilization (over-education or over-skilling), which arises when level of education and skill exceed those required by the job. Apart from the the dead-weight loss of expenditure to acquire higher education and skill, problem of over-education or over-skilling gives birth to another problem. In practice, most of the employers are likely to choose workers with higher education levels to those with lower levels of education, even for jobs that do not require the higher level of education. This reduces the job opportunities for workers with lower but accurate level of education necessary for those jobs. This phenomenon is commonly referred to as 'bumping down' (McGuiness, 2006).

There is already a large literature which has analyzed the causes and consequences of skill shortage and over-education and/or over-skilling. Duncan and Hoffman (1981), Rumberger (1987), Sicherman (1991), Groot (1996), Verdugo and Verdugo (1989) have discovered existence of over education in different labour markets in their studies. Commander and Kollo (2008) have discussed about the problem of skill shortage in blue-collar work during the economic transition which reduces the job opportunities for unskilled workers. Analysis of

[1] Graduates, post graduates and even Ph.D. degree holders applied for the post of peons in Uttar Pradesh State Government Secretariat (2015), for Group D posts in West Bengal State Government Secretariat (2017), for the post of laboratory attendant in Malda Medical College in West Bengal etc. (Source: Hindustan Times, Times of India)

several large-scale employer surveys by Mitra et al in 2010 have shown that, as transition progresses, constraints on business growth due to skill gaps become more prominent. Brixiova et al. (2009) have shown how skill gaps placed constraints on labour reallocation from low to high productivity sectors and thus slowed down the rate of economic growth. Bartlett (2007) has shown that in the European Western Balkan countries, skill mismatches emerged in the higher range of qualifications, with labour surpluses and consequently relatively high unemployment rates among secondary school leavers. According to Masson and Fetsi (2007), vocational schools continued to teach outdated curricula in most countries, providing useless skills. Sondergaard and Murthi, (2011) have shown that education systems in the transition countries need to undergo innate structural reforms in order to become more responsive to the labour market requirements. Mukherjee and Paul (2012) analysed skill mismatch in Indian labour market and found that in case of over-education, both Muslim and SC/ST identity and in case of under education, only Muslim identity had positive significant impact. Unni and Sarkar (2013) did an analysis of skill gaps in the graduate intensity of occupations and high technology manufacturing and knowledge intensive service industry in India and has suggested that a policy encouraging non-graduate technical and non-technical diploma/certificate holders to join the lower graduate intensity occupations to reduce the skill gap and reduce the pressure on graduates of India. However, there is as such no comprehensive and comparative study on job-skill mismatch in India which analyses the problem of all general, technical and vocational education groups across all occupations over a certain period of time during the post economic reform era.

Under this backdrop, this paper aims at a comparative analysis of job-skill mismatch in India using household level data from the Employment and Unemployment Survey in India (schedule 10) of 50th, 61st and 68th quinquennial rounds (for 1993-94, 2004-2005 and 2011-12) conducted by the NSSO. In the beginning of our analysis, we have adopted two standard measures of job-skill mismatch, i.e., the method of standardized variance of relative unemployment rates and the method of proportionality index of unemployment and employment (Arandarenko, M. 2012). Using maximum likelihood probit model, this paper also tries to explore changes in skill gap, over-education or over-skilling of workers in different occupations across several general education, technical, vocational skill, age and gender groups of India using 61st Round (2004-05) and 68th Round (2011-12) unit level employment-unemployment data of NSSO, while data of 50th Round (1993-94) could not be included due to lack of comparability.

Rest of the paper is designed as follows. Section 2 analyses job-skill mismatch in India during the period from 1993-94 to 2011-12 using the method of variance of relative unemployment rates and the method of proportionality index of unemployment and employment. Section 3 discusses about the characteristics of the data used for the empirical analysis, the methodological issues in estimating probit equations and description of the variables incorporated in the empirical analysis. Empirical estimates are analysed in section 4. Section 5 concludes.

2. Analysis of Job-Skill Mismatch using variance of relative unemployment rates and proportionality measures:

2.1 Variance of relative unemployment rates

The variance of relative unemployment rates is the easiest measure of mismatch on the labour market (Lipsey, 1960). This statistical method is an alternative to the coefficient of variation in the sense that where the coefficient of variation needs the distribution of two groups (e.g. of the employed and of the unemployed), the variance of relative unemployment rates relies on the characteristics of one group only (e.g. of the unemployed only). Higher values of the statistic indicate a greater scattering of unemployment rates among groups. It therefore identifies the extent to which some groups are in greater supply/demand imbalance than are others. The formula of variance of relative unemployment rates can be written as:

$$m_u = \text{var}\left(\frac{u_i}{u}\right)$$

Where, u_i is the unemployment rate for group *i* while *u* is the total unemployment rate.

If the unemployment rate of all groups is the same then the variance is zero. The more different are the unemployment rates of the various groups, the higher will be the variance.

In Panel 1, 2, 3 and 4 of Table 1 (in Appendix), we show the variance of relative unemployment rates across general education, technical education, gender and age groups in India during the years 1993-94, 2004-05 and 2011-12. Panel 1 shows that although the variance is low but it increased uniformly over the years. This implies that although all the general

education groups faced the problem of unemployment in a similar fashion, scattering of unemployment rates across different general education groups increased over the years. Panel 2 shows that variance of relative unemployment rate across different technical education groups is higher than that across different general education groups during the whole period of time. It also indicates that although scattering of unemployment rates across different technical education groups declined from 1993-94 to 2004-05, it increased once again in 2014-15. Panel 3 shows that although variance of relative unemployment rate among men and women has been quite low during 1993-94 and 2004-05, it increased drastically in 2011-12. This implies worsening situation of women in the job market of India over the years. Similarly, panel 4 shows that although variance of relative unemployment rate across different age groups has been quite low during 1993-94 and 2004-05, it increased drastically in 2011-12. This implies increase in scattering of unemployment rates across different age groups over the years. In a nutshell, we can safely conclude that scattering of unemployment rates across general education, technical education, gender and age groups has increased over the years. However, from this measure, we cannot identify the source of this increased mismatch. We therefore use a second measure, designed to pinpoint the source of mismatch, which compares the share of each group among the employed and the unemployed.

2.2 Proportionality measures of Job-Skill Mismatch

This measure of mismatch compares the share of unemployed people within a group to the share of employed people within the same level group (Johansen and Gatelli, 2012). The proportionality index measures the deviation from unity of this ratio. When the shares of a group in both unemployment and employment are identical will there be a situation of perfect matching for that group. However, if the share of unemployed people with a given education/gender/age level is less/more than the share in employment the mismatch ratio there will be a negative/positive mismatch. Under the assumption of non-substitutability, positive mismatch can be interpreted as a skill gap. On the other hand, under the assumption of substitutability, this can be interpreted as oversupply of people within that group eligible for getting job which results in 'bumping down' and therefore can be interpreted as an excess supply rather than a skill gap.

In Panel 1, 2 and 3 of Table 2 (in Appendix), we show the proportional job-skill mismatch between different general education groups in India for the years 1993-94, 2004-05 and 2011-12. The table reveals that, all the general education groups have positive mismatch, which is quite obvious in a country like India, where job opportunities are strikingly low. However, in all the years, there is clear indication of the presence of a huge bumping down from graduate and above level to the higher secondary level and marginal bumping downs from higher secondary level to secondary level and so on upto the below primary level. Positive mismatch increases in all the levels over the years and there is a drastic increase in the positive mismatch in the below primary level, may be due to the over-crowding of people with primary education in the jobs suitable for them or presence on skill gap and lack of employment opportunities. For the lower levels of general education, positive mismatches are lower than that of below primary level, may be due to the presence of non-substitutability between below primary level and all the other lower education levels and engagement of people with lower education levels in the extremely low-paid activities of agricultural and non-agricultural informal sector.

Panel 1, 2 and 3 of Table 3 (in Appendix) indicate the proportional job-skill mismatch between different technical education groups in India for the years 1993-94, 2004-05 and 2011-12. During 1993-94, people with diploma or certificate in agriculture got negative mismatch. During 2011-12, people with technical degree in agriculture, engineering, technology or medicine had negative mismatch and they had very small positive mismatches in all the other years. All the other education groups except the no technical education group had moderate levels of positive mismatch throughout the whole period of time. No technical education group had high positive mismatches in all the years. This indicates the presence of a bumping down from the level of technical degree in agriculture, engineering, technology or medicine to the levels of diploma and certificates in all these disciplines. High value of positive mismatch for the people with no technical education indicates the skill gap and lack of job opportunities.

Panel 1, 2 and 3 of Table 4 (in Appendix) indicate the proportional job-skill mismatch between men and women in India for the years 1993-94, 2004-05 and 2011-12. The table reveals that, both men and women had positive mismatches during 1993-94 and 2004-05. However, value of positive mismatch of men is much smaller than the value of positive mismatch of women in both the years. The table also shows that men had negative while women

had positive mismatch in 2011-12. This indicates that women faced the unemployment problem more severely than men may be due to skill gap and gender discrimination.

Panel 1, 2 and 3 of Table 5 (in Appendix) show the proportional job-skill mismatch between different age groups in India for the years 1993-94, 2004-05 and 2011-12. It is observed from the table that there is high positive mismatch for the age group of 11 years to 20 years for the years 1993-94 and 2004-05. However, value of positive mismatch for this group declines considerably in 2011-12. Further, we observe positive mismatch for the age group from 51 years to 60 years throughout the whole period. We find positive mismatches for the age groups from 21 years to 30 years, 31 years to 40 years and 41 years to 50 years for the years 1993-94 and 2004-05. However, we observe negative mismatches for the same groups in 2011-12. These figures imply that there is over-crowding of younger people in all the jobs and this has reduced the chances of people with age group from 51 to 60 years to remain the jobs. Although most of the younger people of age group from 11 years to 20 years preferred less to join the jobs and may have engaged themselves in studies, over the years some of them joined different jobs may be due to increased pressure of poverty.

In this section, we have tried to find out sources of job-skill mismatch using the proportionality index measure which compares the share of unemployed people within a general education, technical education, gender or age group to the share of employed people within the same group. However, in order to further explore changes in skill gap, over-education or over-skilling of workers in different occupations among different groups, we need to do an empirical analysis. In the next section, we discuss about the household level data and methodology used in this paper for the empirical analysis of job-skill mismatch across different occupations in India.

3. Data and Methodology

In this study, we have used the household level data from the Employment and Unemployment Survey in India (schedule 10) of 61st and 68th quinquennial rounds (for 2004-05 and 2011-2012) conducted by the NSSO, while data of 50^{th} round (1993-94) could not be included due to lack of comparability. In the 61^{st} and 68^{th} round, NSS has collected information on workers engaged in different occupations according to NCO codes of 1968 and 2004, respectively. In order to make the data for two rounds comparable, we have used seven

occupations constructed on the basis of one-digit concordance between NCO 1968 and NCO 2004.

In this paper, we carry out empirical analysis using maximum likelihood (ML) probit estimation of the participation equation. In our ML probit participation equation, we have incorporated probability of participation in specific occupations as dependent variable and dummy variables of different levels of general education, technical education, vocational training, dummy variable of females and age as a proxy variable for experience as the independent variables. Participation equation of probit estimation in this study can be written as follows:

$$\pi_{occupation} = \phi(a_0 + \sum_{i=1}^{5} b_i D_i^{gen_edu} + \sum_{i=6}^{17} b_i D_i^{tech_edu} + \sum_{i=18}^{24} b_i D_i^{voc_training} + b_{25} age + b_{26} D^f + u)$$

Here, we have included seven occupations constructed on the basis of one-digit concordance between NCO 1968 and NCO 2004. These seven occupations are Professional and Associate Professionals, Administrators and Managers, Clerks, Sales and Service Workers, Skilled Agricultural and Fishery Workers, Craftsmen, Machine Operators and Labourers, Unskilled Workers. Therefore, we have estimated seven such equations for each of the 61st round and 68th round. Table 6 (in Appendix) explains all the variables used in the participation equation.

4. Empirical results

Empirical results of ML probit estimation of the participation equation based on unit level information are presented in Table 7 (in Appendix). In the first equation, we have included probability of joining the occupation of professionals and associate professionals as the dependent variable. We can assume the occupation of professionals and associate professionals as an occupation with high intensity of graduate and above level of general education or any technical degree of graduate and above level, since most of the jobs[2] in this category need

[2] Scientists, Technicians, Engineers, Surgeons, Mathematicians, Statisticians, Economists, Teachers, Journalists, Jurists, Poets, Authors, Sculptors, Painters, Photographers and related Creative Artists, Nurses and other Medical and Health Technicians, Social Scientists etc.

employees with such qualifications. From Table 7, we observe that in both the years, not only graduate and post graduate level, but lower levels of general education also had significant positive probability of participation in the occupation of professionals and associate professionals. However, value of the coefficients for all these categories decreased over the years. This implies that probability of getting job as professionals and associate professionals declined for graduates and post-graduates. People with graduate and above degree in technical education also had positive and significant probability of joining this occupation for both the years. Moreover, diploma holders of graduate or more level (except crafts) in technical education also had positive and significant coefficients throughout the whole period. Among the less than graduate level diploma holders, only diploma holders in medicine had positive and significant coefficients for both the years. Value of the positive coefficient increased for all these categories (except less than graduate level diploma holders in medicine). People who were having vocational training and who already had vocational training, had higher probability of getting this job. This implies that in the occupation of professionals and associate professionals, technical degree and diploma holders got better opportunities than graduates and post-graduates in general education over the years and vocational training also played the role of an additional qualification in this respect, which people with degrees in general education might not have. Age had a positive and significant influence on probability of joining this occupation although this impact declined over the years. Moreover, women had greater probability than men in joining this occupation.

In the second equation, we have included probability of joining the occupation of administrators and managers as the dependent variable. We can assume the occupation of administrators and managers as an occupation with high intensity of graduate and above level of general education, since most of the jobs[3] in this category need employees with such qualifications. Table 6 shows that the general education groups secondary, higher secondary, graduate and post graduate had positive and significant coefficients. However, probabilities of joining this job declined for graduates and post graduates and increased for the secondary and higher secondary groups during the period of our analysis. Those having graduate or above level

[3] Elected and legislative officials, Administrative and executive officials, govt & local bodies, Proprietors, Directors, Managers etc.

diploma in engineering or technology also had positive and significant probability of joining this occupation, although the probability declined over time. People having hereditary and other kinds of non-formal vocational skills had positive and significant probability to join the occupation of administrators and managers. However, in 2011-12, people having formal vocational training had significant and higher probability of joining such jobs than those who got non-formal vocational training. This implies that, lately such jobs needed formal vocational skills. Age had a positive and significant influence on probability of joining this occupation although this impact declined over the years. However, women had lower probability than men in joining this occupation.

In the third equation, we have used probability of joining the occupation of clerks as the dependent variable. We can consider the occupation of clerks as a non-graduate occupation, since such jobs[4] do not need employees with graduate or above level of general education. Essential qualification of such jobs is secondary or higher secondary level of general education and a certain level of vocational training for certain categories within this group. Surprisingly, not only the secondary or higher secondary groups, but the graduate and post graduate groups were also found to have positive and significant coefficients. Furthermore, values of coefficients were higher for graduates and post graduates than secondary and higher secondary groups and these values increased over the years. People with no technical education, having below graduate engineering/technology diploma and diploma in other subjects also had positive and significant probabilities of joining the job of clerks. Since jobs of stenographers, typists, computing machine operators etc might need some training, people who were receiving or had already received formal vocational skill, were found to have positive and significant probabilities of joining the job of clerks. However, people with no formal vocational skill were also found to have positive and significant coefficient throughout the whole period of our study. These results imply that, clerical job sector was such a sector, where there was over-crowding of over-educated and over-skilled people who did not find any job suitable for their own levels of education or skill. Obviously, these people pushed out most of the people with secondary or higher secondary

[4] Clerical and other Supervisors, Telegraphists and Signalers, Purchasing Agents, Village Officials, Stenographers, Typists and Card and Tape Punching Operators, Book keepers, Cashiers and related workers, Computing Machine Operator, Transport & Communication Supervisors, Transport Conductor and Guards, Mail Distributors and related workers, Telephone and Telegraph operators, etc.

levels of education from this occupation, although they had enough education and skill for such jobs. Age had a positive and significant influence on probability of joining as a clerk although this impact has declined over the years. However, women had lower probability than men in joining this occupation.

In the fourth equation, we have used probability of joining the occupation of sales and service workers as the dependent variable. We can consider the occupation of sales and service workers as a low graduate intensive occupation, since such jobs[5] do not necessarily need employees with graduate or above level of general education. Anybody having secondary or higher secondary level of general education and some vocational training for certain categories of jobs can work in this occupation. However, certain sales jobs may require fluency in different languages to communicate with the clients and arithmetic skill to keep daily accounts. Consequently, post graduates had significant and negative probability of joining this occupation, whereas, graduates were found to have positive and significant coefficients in both the years. People with below graduate technical or engineering diploma and some other subjects also had positive and significant probabilities to join the job of sales and service workers. People with no technical education also had positive and significant probability of joining this job. People with formal vocational training had positive and significant coefficient. However, people without any vocational training also had positive and significant coefficient. Age has a positive and significant influence on probability of joining this job although this impact has declined over the years. Womem had lower probability than men in joining this occupation. These results imply that, in the occupation of sales and service workers, although there was no such necessity of technical education, people with below graduate level of technical skill entered in these jobs. Some people had vocational training and some others did not have that. So, there was a mixed crowd in this occupation and those who had exactly required qualification were to some extent bumped down by those who are over-skilled with technical education.

[5] Money lenders and pawn brokers, Merchants & shopkeepers, wholesale & retail trade, Manufacturers' agents, Technical salesmen and commercial travelers, Salesmen, shop assistants and related workers, Insurance, real estates, securities & business service salesmen & auctioneers, Hotel and restaurant keepers, House keepers, matrons & stewards (domestic and institutional), Cooks, waiters, bartenders & related workers(domestic & institutional), Building caretakers, sweepers, cleaner & related workers, Launderers, drycleaners and pressers, Hair dressers, barbers, beauticians & related workers, etc.

In the fifth equation, we have used probability of joining the occupation of skilled agricultural and fishery workers as the dependent variable. We can consider the occupation of skilled agricultural and fishery workers as a non-graduate occupation, since such jobs[6] do not need employees with graduate or above level of general education. However, as the name of the occupation mentions, such jobs need job-specific skills. From Table 7 it is clearly evident that, although in 2004-05, people with primary and secondary education had negative and significant probabilities of joining the work of skilled agricultural and fishery workers, in 2011-12 they had positive and significant probabilities of joining the same work. People with no technical education had positive and significant probability of joining the occupation of skilled agricultural and fishery workers. It is not surprising that people with below graduate diploma in agriculture had positive and significant probability of joining such work. However, it is quite surprising that people with below graduate diploma in engineering or technology, crafts and other subjects also had positive and significant probability of joining this work. Those who got non-formal hereditary skills for these works or acquired such skill through self-learning, had positive and significant probability of joining this occupation. However, those who had no such vocational skill, also had positive and significant probability of joining this occupation. Age had a negative and significant influence on probability of joining as skilled agricultural and fishery workers in 2004-05. However, in 2011-12, age had positive and significant influence on probability of joining this occupation. Women had higher probability than men in joining this occupation. These results imply that although the occupation of skilled agricultural and fishery workers is a low paid job which needs very low level of education, we observe that people up to secondary level of general education and less than graduate level diploma holders in different subjects including engineering and technology had significant inclination towards joining this occupation. Women had obviously higher probability of joining this occupation since most of Indian women are concentrated in the low paid jobs of the agricultural and fishery sector. Aged persons, who might not have opportunity to work in other occupations, had joined this occupation although it was quite low paid one.

[6] Cultivators, Farmers other than Cultivators, Agricultural Labourers, Plantation Labourers and related Workers, Forestry Workers, Hunters and related Workers, Fishermen and related Workers, etc.

In the sixth equation, we have used probability of joining the occupation of craftsmen and machine operators as the dependent variable. We can assume this occupation as a non-graduate occupation, since such jobs[7] do not need employees with graduate or above level of general education. However, it is quite clear that such jobs need job-specific skills. It is quite understandable that those who had primary and secondary level of general education, would have positive and significant probability of joining this occupation. But we also observe that people without any technical education had positive and significant coefficient. We also observe that people with formal vocational training had positive and significant probability of joining this job. Moreover, people who had non-formal hereditary vocational training and who acquired skill by self-learning were also found to have positive and significant coefficients. This implies that since many people without any job-specific skill were entering in this occupation, they were acquiring this skill through vocational training from different sources. Those who had below graduate diploma in crafts or other subjects were also found to have positive and significant probability of joining this occupation. However, we also find that those who had below graduate level diploma in engineering and technology, had positive and significant probability of joining the occupation of craftsmen and machine operators. They were over-educated/over-skilled people for this occupation. These people should have been absorbed in the occupation of professionals and associate professionals. Age had a negative and significant influence on probability of joining as craftsmen and machine operators in both the years. Women had lower probability than men in joining this occupation. These results suggest that although the job of craftsmen and machine operators needs low level of general education but job-specific skill, people without any technical education had high probability of joining this job. People with vocational training from different sources were found to be absorbed in these jobs. However, over-skilled people with diploma in engineering or technology were also found to work in this occupation. Hence, if there was a job-skill mismatch in this sector, it could be the mixed result of skill gap as well as over-skilling. Age had a negative and significant influence on probability of joining as craftsmen and

[7] Miners, Quarrymen, Well Drillers & related workers, Metal Processers, Wood Preparation workers and Paper Makers, Chemical Processors and related workers, Spinners, Weavers, Knitting, Dyers and related workers, Tanners, Fellmongers and Pelt Dressers, Food and Beverage processors, Tobacco Preparers & Tobacco Product Makers, Tailors, Dress Makers, Sewers, Upholsterers & related workers, Shoemakers and Leather Goods Makers, Carpenters, Cabinet and related Wood Workers, Stone Cutters and Carvers, Blacksmiths, Tool-makers and Machine Tool Operators, etc.

machine operators. Since women had less skilled than men, they had less possibility to get employed in this skill-based occupation.

In the seventh and final equation, we have used probability of joining the occupation of labourers and unskilled workers as the dependent variable. It is quite evident that the occupation of labourers and unskilled workers in a non-graduate job. In fact, it is the least skilled and least paid job among all the jobs and it needs a very low level of general education. This occupation[8] can be addressed as an elementary occupation. It is quite understandable that people with primary level of general education, no technical education and no vocational training had positive and significant probability of working as labourers and unskilled workers. However, it is surprising that people with below graduate diploma in crafts or in other subjects also had positive and significant probability of doing these works. It is also quite shocking that during 2011-12, people with below graduate diploma in engineering and technology were found to have positive and significant probability of joining this occupation. In 2004-05, people with non-formal hereditary vocational training had negative and significant probability of joining this occupation, since they managed to find the job in the occupation of craftsmen and machine operators. However, in 2011-12, these people might no longer find any work in the occupation of craftsmen and machine operators and therefore, they had positive and significant probability of joining the occupation of labourers and unskilled workers. People who acquired non-formal vocational training from other sources also had positive and significant coefficients. Age had no influence on probability of joining as labourers and unskilled workers in 2004-05. However, in 2011-12, age has negative and significant influence on probability of joining this occupation, which implies that since there was over-crowding of over educated and over skilled people in this occupation, older people were being pushed out from such works. Women had less chances of getting such jobs than men during 2004-05. However, during 2011-12, women had greater probability of joining this occupation than men. This implies that probabilities of women to be confined within low paid and low skilled jobs are increasing over time.

5. Conclusions

[8] Domestic Servants, Building Caretakers, Sweepers, Cleaner & related workers, Watchmen, Chowkidars and Gate Keepers, Loaders and Unloaders, Checkers, Testers, Sorters, weighers and Counters, Packers, Labellers and related workers, Drivers, Animal and Animal Drawn Vehicles, Cycle Rickshaw Drivers and Rickshaw Pullers, Mail Distributors and related workers, n.e.c., Labourers, n.e.c.

This study analyses the job-skill mismatch in India using household level data from the Employment and Unemployment Survey in India (schedule 10) of 50^{th}, 61^{st} and 68^{th} quinquennial rounds (for 1993-94, 2004-2005 and 2011-12) conducted by the NSSO. We have tried to measure the mismatch using the methods of standardized variance of relative unemployment rates and proportionality index of unemployment. Using probit model, we have also tried to explore changes in skill gap, over-education or over-skilling of workers in different occupations across several general education, technical, vocational skill, age and gender groups of India using 61^{st} and 68^{th} Round unit level employment-unemployment data of NSSO during 2004-05 and 2011-12.

In our first analysis of variance of relative unemployment rates, we find that although all the general education groups faced the problem of unemployment in a similar fashion, scattering of unemployment rates across different general and technical education groups increased over the years. In this respect, women were found to be in a more disadvantageous position compared to men. While measuring the proportionality of job-skill mismatch, we observe that during the whole period of our study, all the general education groups had positive mismatch, i.e. share of unemployment was more than share of employment for all the groups. We also find the presence of a huge bumping down or downgradation of employment from graduate and above level to the higher secondary level and marginal bumping downs from higher secondary level to secondary level and so on upto the below primary level. People with below primary level education might have experienced high positive mismatch due to the over-crowding of people with higher levels of education in the jobs suitable for them, presence of skill gap and lack of employment opportunities. People with extremely low levels of education had lower positive mismatch compared to below primary level, may be because of their engagement in the extremely low-paid activities of agricultural and non-agricultural informal sector. We also observe the presence of a bumping down from the level of technical degree in agriculture, engineering, technology or medicine to the levels of diploma or certificate in all these disciplines. We further observe high value of positive mismatch for the people with no technical education, which indicates the existence of skill gap.

Results of our empirical analysis show that in the occupation of professionals and associate professionals, technical degree and diploma holders had better opportunities than

graduates and post-graduates in general education during the period of our analysis and vocational training also played the role of an additional qualification in this respect, which people with degrees in general education may not have.

On the other hand, in the occupation of administrators and managers, people with general education from secondary to the post graduate level had positive probabilities of getting employment. However, we observe decline in the chances of graduates and post graduates and increase in the chances of people with secondary and higher secondary level of general education, with graduate or above level diploma in engineering or technology and with formal vocational training. Therefore, it is evident that chances of getting jobs declined for graduates and post graduates declined in the occupation of professionals and associate professionals and in the occupation of administrators and managers which were most suitable for them. Hence it is plausible to assume that graduates and post graduates would search for jobs which need lower levels of education. Empirical results support this assumption.

Clerical job sector suffered from over-crowding of graduates and post graduates in general education and people with below graduate level diploma in engineering/technology and in other subjects. All these over-educated and over-skilled people might not find any job suitable for their own levels of education or skill. Certain works within this occupation needed job-specific skills and therefore people having formal vocational training had significant positive chances of getting jobs in this occupation. Obviously, these people pushed out most of the people with secondary or higher secondary levels of education from this occupation, although they had enough education for such jobs.

In the occupation of sales and service workers, although there was no such necessity of technical education, people with below graduate level of technical skill entered in these jobs. Some people had vocational training and some others did not have that. So, there was a mixed crowd in this occupation and those who had exactly required qualification were to some extent pushed out of this sector by those who were over-skilled with technical education.

The occupation of skilled agricultural and fishery workers was a low paid job which needed very low level of education. Therefore, it is obvious that people up to secondary level of general education would have positive and significant chances of getting such jobs. However,

this is surprising that less than graduate level diploma holders in different subjects including engineering and technology had significant inclination towards joining this occupation.

Although the job of craftsmen and machine operators needed low level of general education but job-specific skill, people without any technical education had high probability of joining this job. People with vocational training from different sources were found to be absorbed in these jobs. However, over-skilled people with diploma in engineering or technology were also found to work in this occupation. Hence, if there was a job-skill mismatch in this sector, it could be a mixed result of skill gap as well as over-skilling.

The job of labourers and unskilled workers is the least skilled and least paid job among all the jobs and it needs a very low level of general education. Therefore, it is not surprising that people with primary level of general education, no technical education and no vocational training had positive and significant probability of working as labourers and unskilled workers. However, it is surprising that people with below graduate diploma in engineering and technology, crafts or in other subjects had positive and significant probability of doing these works. This implies that over-educated and over-skilled people who did not find jobs in the occupations like professionals and associate professionals, administrators and managers and sales and service workers, found work in the occupation of labourers and unskilled workers.

From the proportionality measures we observe that in terms of job-skill mismatch, women were in a worse condition compared to men. Our empirical results suggest that women had greater probability than men in joining the occupations of professionals and associate professionals, skilled agricultural and fishery workers and labourers and unskilled workers. In all the other occupations, women had less probability of getting jobs. This means except the highly educated women who got formal sector jobs as professionals and associate professionals all the other women with lower levels of education could not find any well-paid jobs. They were concentrated in the low paid jobs of agricultural and fishery workers and labourers and unskilled workers.

The analysis of proportionality of job-skill mismatch reveals that engagement of younger people with age group to 11 to 20 years, in different jobs increased over the years. This implies the increasing pressure of poverty on the families which compelled these young people to leave

their studies and start working to earn money. On the other hand, chances of older people of age group from 51 to 60 years were found to decline due to over-crowding of younger people in the job market. Our empirical analysis shows that in most of the occupations aged people were pushed out by younger people. This implies the in the globalized market employers were demanding newer skills and skills of older people were increasingly becoming obsolete. Furthermore, since there was over-crowding of over educated and over skilled younger people in the lowest-paid occupation of labourers and unskilled workers, older people were being pushed out even from such works.

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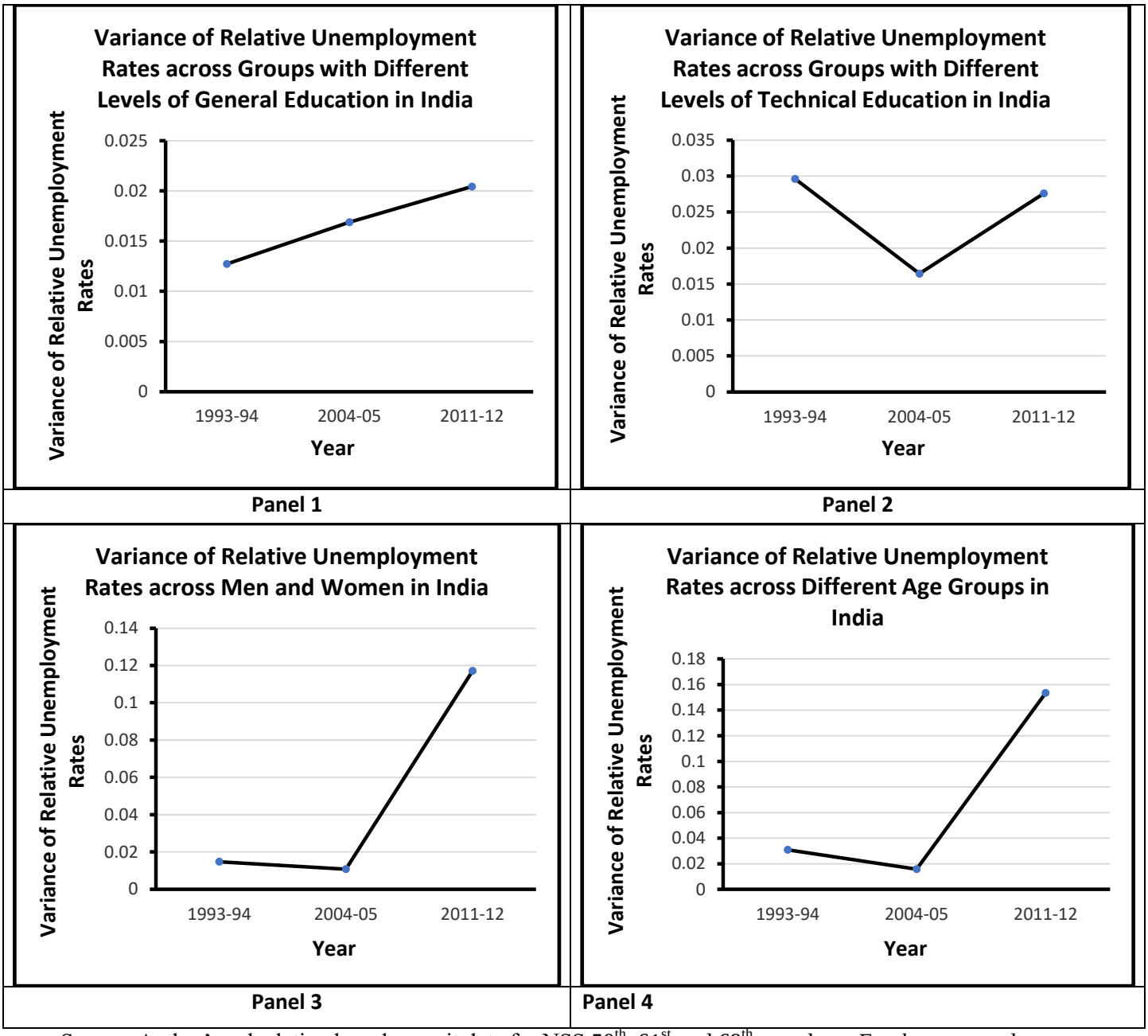
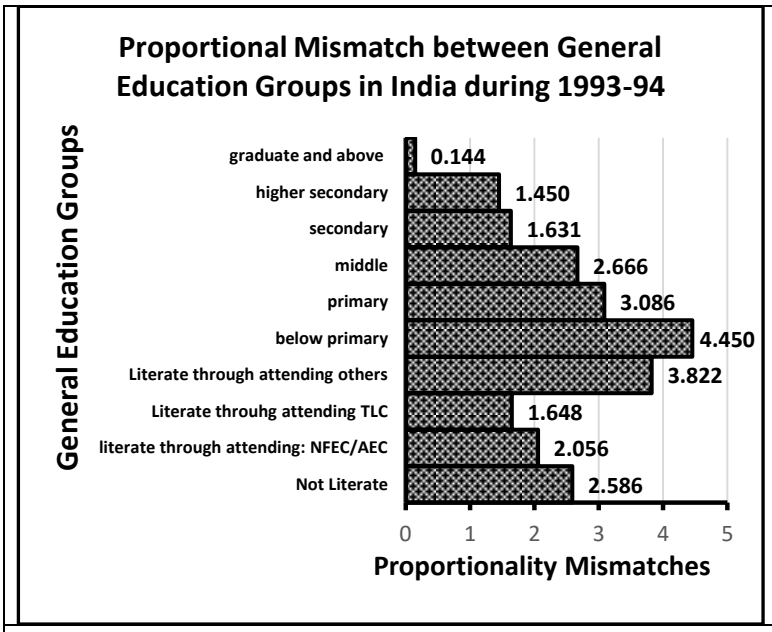
Appendix

Table 1 Variance of Relative Unemployment Rates across Different Groups in India

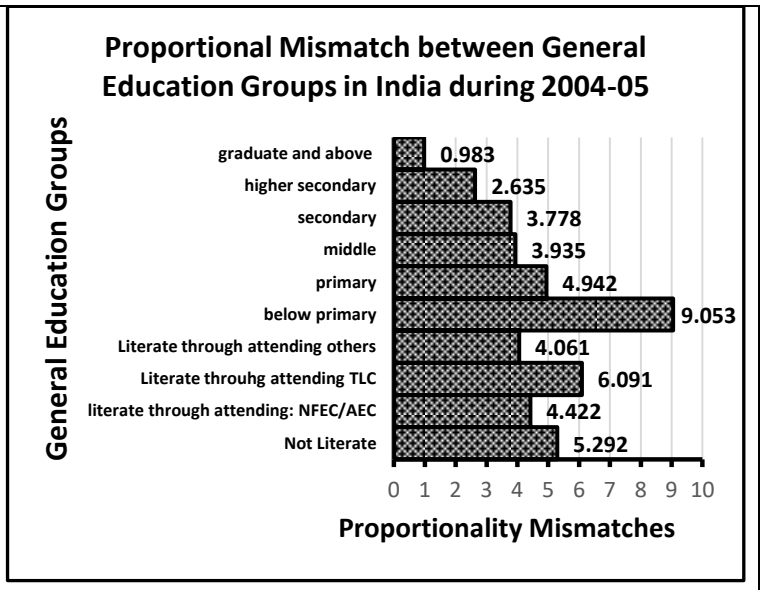


Source: Author's calculation based on unit data for NSS 50th, 61st and 68th rounds on *Employment and Unemployment Situation in India*

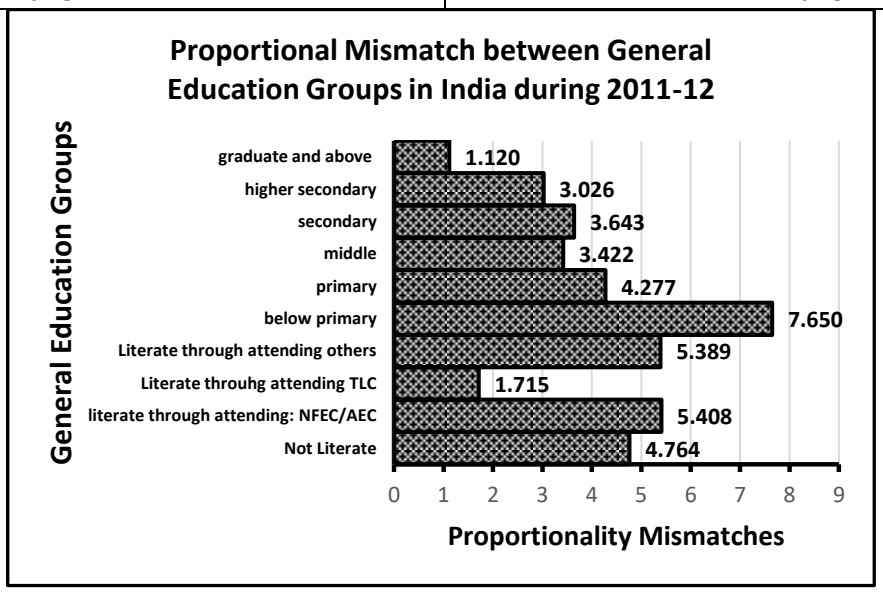
Table 2 Proportional Job-Skill Mismatch between Different General Education Groups in India



Panel 1



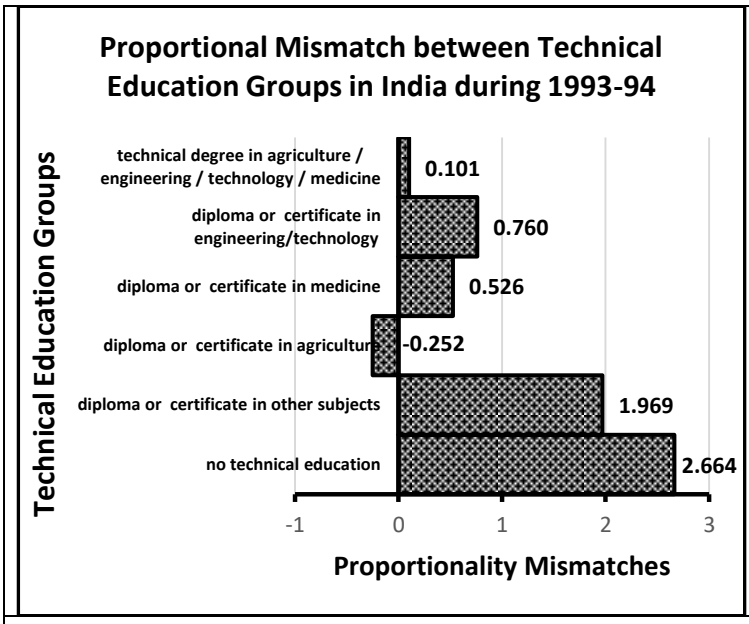
Panel 2



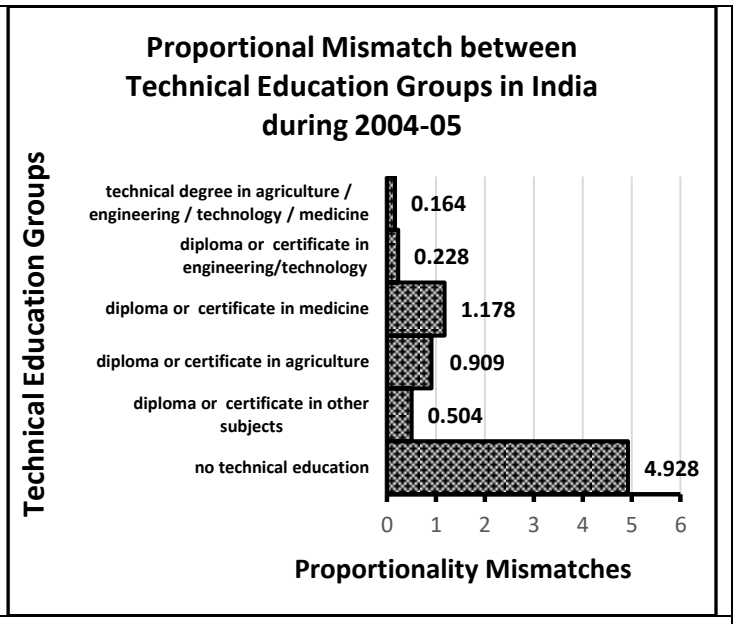
Panel 3

Source: As for Table 1

Table 3 Proportional Mismatch between Different Technical Education Groups in India



Panel 1



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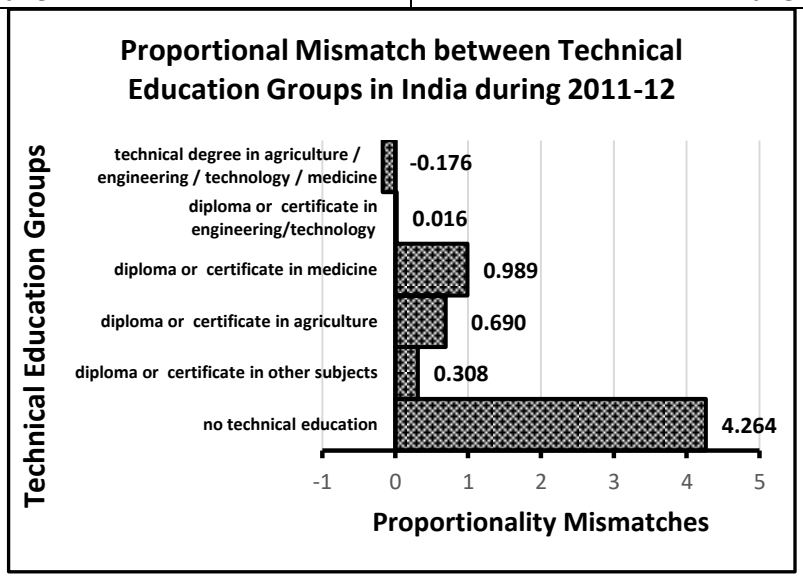
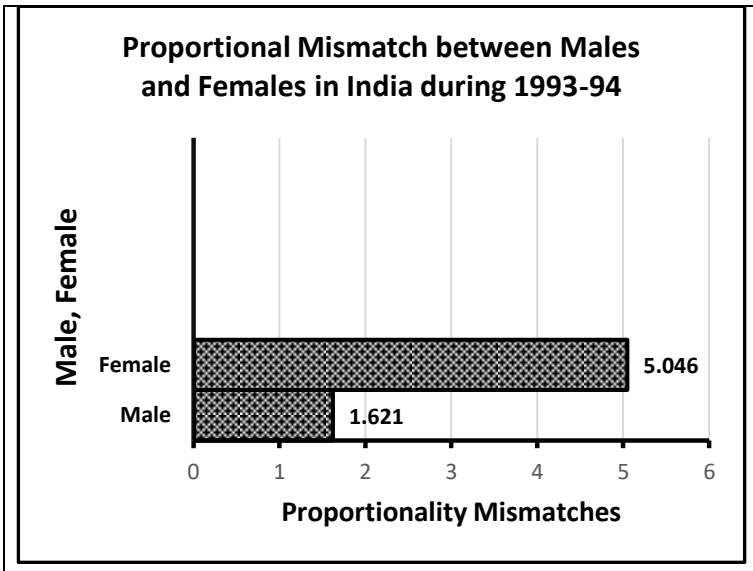


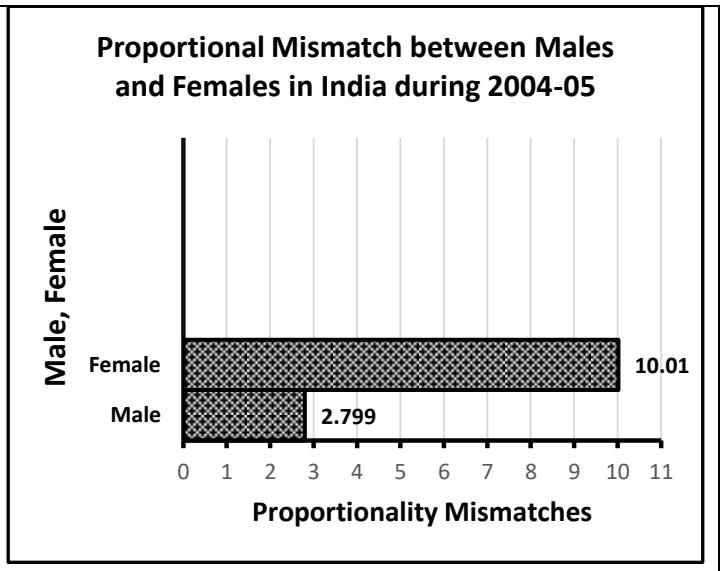
Panel 3

Source: As for Table 1

Table 4 Proportional Mismatch between Men and Women in India



Panel 1



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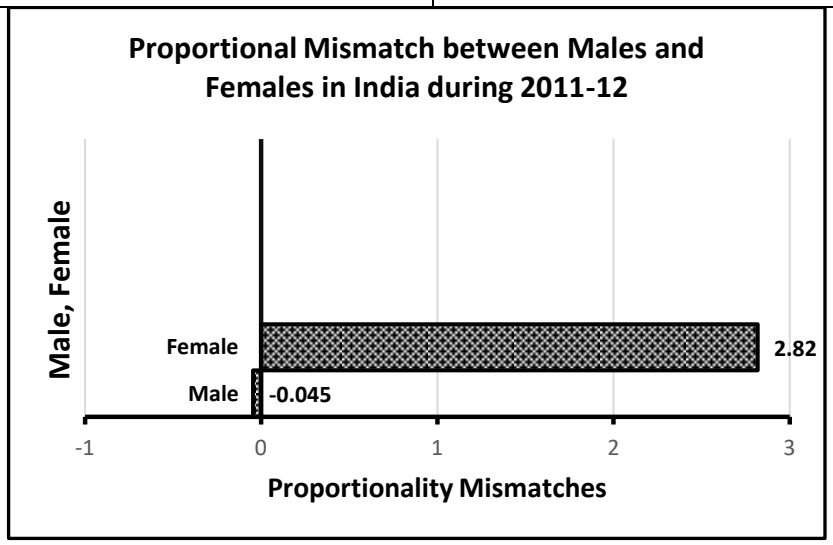
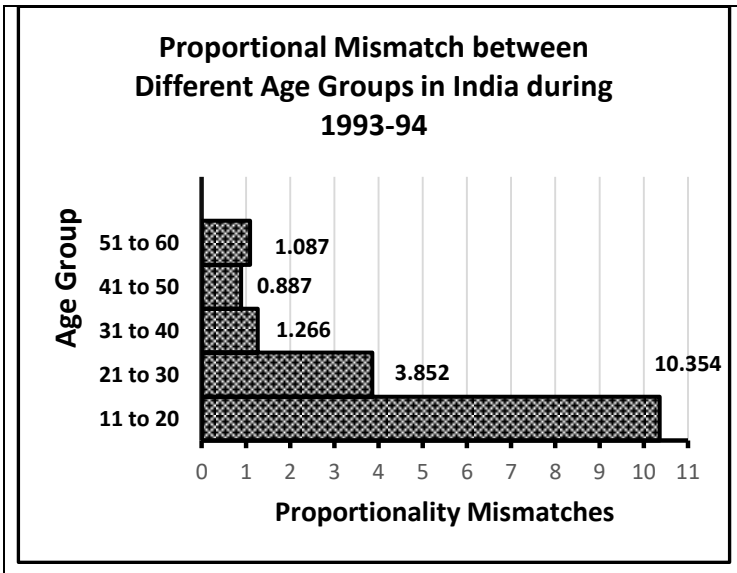


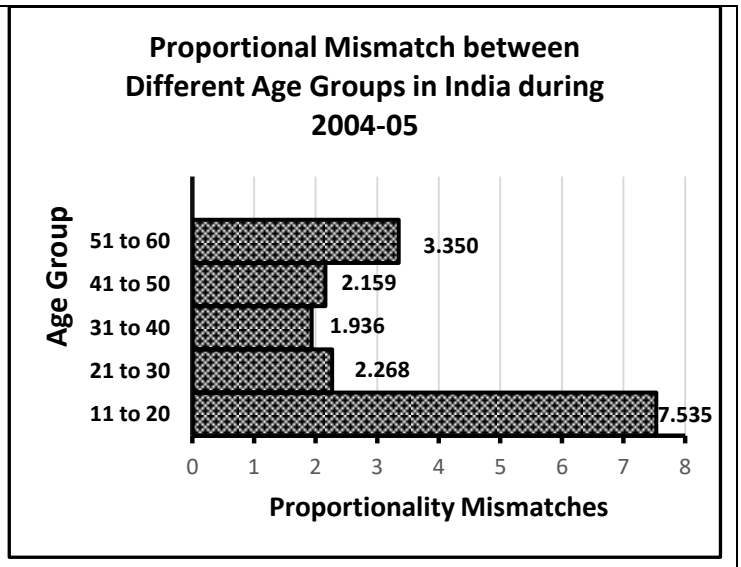
Panel 3

Source: As for Table 1

Table 5 Proportional Mismatch between Different Age Groups in India



Panel 1



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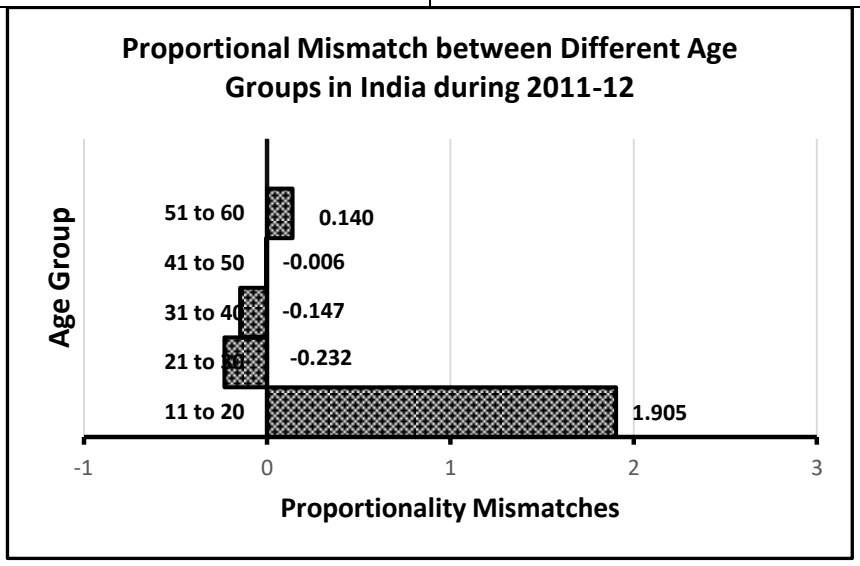

Panel 3

Source: As for Table 1

Table 6 Explanation of variable names used in participation equation

Name of the Variable	Explanation
$\Pi_{occupation}$	Probability of participation in a particular occupation, equal to 1 if the person participates in the occupation, 0 otherwise.
Di^{gen_edu}	Dummy variable for ith level of general education, equal to 1 if the person has ith level of general education and 0 otherwise.
Di^{tech_edu}	Dummy variable for ith level of technical education, equal to 1 if the person has ith level of technical education and 0 otherwise.
$Di^{voc_training}$	Dummy variable for ith level of vocational training, equal to 1 if the person has ith level of vocational training and 0 otherwise.
D^f	Gender dummy variable, equal to 1 for women and 0 for men
age	Age of the person

Table 7 ML Probit estimates of participation in different occupations

Variables		Occupation (According to 1 Digit Concordance between NCO 1968 and NCO 2004)					
		Professional and Associate Professionals (1)		Administrators and Managers (2)		Clerks (3)	
		2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
General Education	Primary						
	Secondary	0.48*	0.34*	0.20*	0.23*	0.35*	0 .39*
	Higher Secondary	1.44*	1.42*	0.13*	0.22*	0.49*	0.59*
	Graduate	1.58*	1.46*	0.48*	0.39*	0.99*	1.01*
	Post-Graduate	2.09*	1.97*	0.56*	0.40*	0.70*	0.81*
Technical Education	No Technical Education					**0.24***	**0.29***
	Technical Degree Agriculture/Engineering/Technology/Medicine etc.	**0.56***	**0.72***	-0.17	-0.19*		
	Diploma/Certificate (below Graduate) in Agriculture	-0.21	-0.20	0.06	0 .08	0.45	-0.002
	Diploma/Certificate (below Graduate) in Engineering/Technology	-0.18*	-0.27*	0.12	-0.08**	**0.38***	**0.18***
	Diploma/Certificate (Below Graduate) in Medicine	**1.15***	**0.88***	-0.21	-0.29*	-0.55**	-0.51*
	Diploma/Certificate (Below Graduate) in Crafts	-0.55*	-0.43*	-0.46	0.07	-0.54	0.03
	Diploma/Certificate (below Graduate) in Other Subjects	0.31*	-0.04	-0.03	-0.08	**0.33***	**0.33***
	Diploma/Certificate (Graduate and Above) in Agriculture	**0.21**	**0.39**	-0.16	0.09	-0.75**	0
	Diploma/Certificate (Graduate and Above) in Engineering/Technology	**0.01**	**0.28***	**0.31***	**0.13***	0.17	0.06
	Diploma/Certificate (Graduate and Above) in	**0.80***	**0.97***	-0.12	-0.44*	-0.17	-0.95*

	Medicine						
	Diploma/Certificate (Graduate and Above) in Crafts	-0.51**	-0.70*	-0.39	0.40	-0.28	0.13
	Diploma/Certificate (Graduate and Above) in Other Subjects	**0.36***	**0.43***				
Vocational Training	Receiving Formal Vocational Training	0.39*	0.37*	0.14**	0.04	**0.90***	**0.43***
	Received Formal Vocational Training	0.14*	0.34*	0.09**	**0.13***	**0.95***	**0.51***
	Received Non-formal (Hereditary) Vocational Training	-0.17*	-0.27*	**0.11***	**0.01***		-0.68*
	Received Non-formal (Self Learning) Vocational Training	0.07***	-0.11	0.20*	0.21*	0.34*	-0.13
	Received Non-formal (Learning on the Job) Vocational Training		-0.03		-0.05*		0.17
	Received Non-formal (Others) Vocational Training						
	Did not receive any Vocational Training	0	0.12**			**0.49***	**0.24***
	Age	0.04*	0.01*	0.03*	0.01*	0.03*	0.01*
	Female	0.39*	0.16*	-0.23*	-0.27*	-0.09*	-0.09*
	Constant	-3.23*	-2.19*	-2.49*	-1.73*	-3.78*	-3.09*

Source: Author's calculation based on data as for Table 1

* $p \leq 0.01$, **0.01 $p \leq 0.05$, ***0.05 $p \leq 0.1$

Table 7 ML Probit estimates of participation in different occupations (Contd.)

Variables		Occupation (According to 1 Digit Concordance between NCO 1968 and NCO 2004)							
		Sales and Service Workers (4)		Skilled Agricultural and Fishery Workers (5)		Craftsmen, Machine Operators (6)		Labourers, Unskilled Workers (7)	
		2004-05	2011-12	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
General Education	Primary			-0.02*	0.06*	0.13*	0.14*	0.04*	0.05*
	Secondary	0.26*	0.26*	-0.19*	0.02**	0.11*	0.02*	-0.26*	-0.46*
	Higher Secondary	0.01	-0.09*	-0.52*	-0.36*	-0.08	-0.14*	-0.39*	-0.86*
	Graduate	0.32*	0.11*	0.72*	-0.49*	-0.39*	-0.73*	-0.85*	-1.28*
	Post-Graduate	0.006	-0.31*						
Technical Education	No Technical Education	0.34*	0.36*	0.81*	0.79*	0.42*	0.61*	0.30*	1.17*
	Technical Degree Agriculture/Engineering/Technology/Medicine etc.	-0.09	-0.18***	0.68*	-0.06	0.04	0.09		
	Diploma/Certificate (below Graduate) in Agriculture	0.14	0.04	1.56*	0.94*	0	0.67*	0.43	1.42*
	Diploma/Certificate (below Graduate) in Engineering/Technology	0.34*	0.28*	0.68*	0.63*	0.84*	0.92*	0.09	0.93*
	Diploma/Certificate (Below Graduate) in Medicine	0.81*	0.20	0.07	0.26**	-0.35	-0.47*	-1.02*	0
	Diploma/Certificate (Below Graduate) in Crafts	0.21	0.48*	0.72*	0.43	1.29*	1.06*	0.39**	0.84**
	Diploma/Certificate (below Graduate) in Other Subjects	0.41*	0.18**	0.49*	0.57*	0.43*	0.68*	0.25**	0.89*
	Diploma/Certificate (Graduate and Above) in Agriculture	0.79*	-0.20	0.44	0.01	0	0.57***	0.02	0
	Diploma/Certificate (Graduate and Above) in Engineering/Technology	0.09	-0.12	0.44*	0.06	0.18	0.19**	0.08	0.32**
	Diploma/Certificate (Graduate and Above) in	-0.03	-0.08	-0.09	-0.15	0	-0.83*	-0.35	-0.08

	Medicine								
	Diploma/Certificate (Graduate and Above) in Crafts	-0.03	0.26	1.43*	1.11*	1.16*	0.63**	0.15	0
	Diploma/Certificate (Graduate and Above) in Other Subjects								
Vocational Training	Receiving Formal Vocational Training	0.39*	0.10*	-0.76*	-0.12**	0.45*	0.49*	0.08	-0.01
	Received Formal Vocational Training	0.36*	0.17*	-0.75*	-0.07	0.49*	0.47*	0.23*	-0.04
	Received Non-formal (Hereditary) Vocational Training	0.15*	0.02	0.07*	1.09*	0.54*	0.15*	-0.42*	0.26*
	Received Non-formal (Self Learning) Vocational Training				0.17*		0.77*		0.26*
	Received Non-formal (Learning on the Job) Vocational Training			-0.78*	-0.19*	1.05*	0.21	0.15*	0.36*
	Received Non-formal (Others) Vocational Training								
	Did not receive any Vocational Training	0.44*	0.28*	0.79*	0.59*	-1.05*	-1.05*	0.10*	0.81*
	Age	0.002	0.001*	-0.01*	0.004*	-0.02*	-0.01*	0	-0.01*
	Female	-0.32*	-0.24*	0.55*	0.39*	-0.04*	-0.44*	-0.73*	0.10*
	Constant	-1.82*	-1.85*	-0.74*	-2.23*	-1.32*	-1.02*	-1.09*	-2.25*

Source: Author's calculation based on data as for Table 1

* $p \leq 0.01$, **0.01 $p \leq 0.05$, ***0.05 $p \leq 0.1$