

Skill Mismatch and Labor Productivity: Evidence from Two Emerging Sectors of Bangladesh

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Conceptual Issues: Skill Mismatch

- **Skill Mismatch**

Skill mismatch refers to various types of imbalances between skills offered (supplied) and skills needed (demanded) in the labor market.

- Various types of skill mismatch

- Skill Gap

- Skill Shortage

- Vertical Mismatch (over-education, under-education)

- Horizontal Mismatch (field of study)

- Skill mismatch, in all of its forms, is a major source of labor underutilization.

- In this study we focus only on vertical and horizontal mismatch

Vertical mismatch (Over-education and Under-education)

- Measured at the level of individual's circumstances, over-education and under-education refer to the degree to which workers' education levels are above, below or poorly matched to those required for their current jobs.

Measurement:

- Comparison of desired and actual level of education level for an occupation

Horizontal Mismatch (mismatch of field of study)

- Horizontal Mismatch refers to situations where workers get employed in jobs that are neither related to their education, nor their skills and knowledge. The measure identifies any mismatch between the workers' primary field of study and the skill required for their current jobs.

Measurement:

- Comparison of desired and actual level of field of education for an occupation

Objective of the study

- Educational mismatch
 - i. What is the extent of vertical (level of education) and horizontal mismatch (field of education)?
 - ii. What is the effect of these two mismatch on firm-level labor-productivity?
 - iii. What is the effect of these two mismatch on wage rates of the workers?

Literature review

- Vertical mismatch (over education): Disequilibrium or equilibrium? Irrational or rational response?
- Overeducated people earn more than people who work in equivalent jobs but have attained the level of schooling required for that job (Sicherman, 1991; Sloane, 2003).[developed countries]
- Positive (negative) impact of over- (under-)education on firm productivity

The effect of over-education on productivity is stronger among firms: (i) with a higher share of high-skilled jobs, (ii) belonging to high-tech/knowledge-intensive industries. (Mahy et al. 2015) [Belgium, panel, 1999-2010]

- Job-worker mismatch induces a cognitive decline with respect to immediate and delayed recall abilities, cognitive flexibility and verbal fluency (de Grip et al, 2008) [Netherlands]
- Hardly any evidence for developing countries!

Data

- Labor market study of SEIP (Skills for Employment Investment Program)
- Two sectors:
 - Light engineering: Capital machinery (full machine), construction equipment, spare parts for automobiles/agro-processing, body for bus, car, van, others
 - Electronics: Light, fan, television, home appliances, battery, generator, transformer

Light engineering: 123

Electronics: 100

Unit of analysis: Firm-occupation level: 2221

Occupation groups: Managers, professionals, technicians and associate professionals, service and sales workers, craft workers and plant workers

Incidence of mismatch

- Table: Desired and actual level of education (in Years)

Occupations	No. of reported workers	Desired level of education by the firms	Actual level of education by the firms
Managers	948	11.004	9.788
Professionals	22	14.318	12.409
Technicians and associate professionals	162	10.710	8.370
Service and sales workers	97	9.649	7.639
Craft workers and plant operators	992	9.252	6.184
Total	2221	10.174	8.007

Table: Incidence of vertical mismatch

Occupations	No. of reported workers	No. (share) of workers with vertical mismatch	No. (share) of workers with over-education	No. (share) of workers with under-education
Managers	948	625 (65.93)	190 (20.04)	435 (45.89)
Professionals	22	10 (45.45)	2 (9.09)	8 (36.36)
Technicians and associate professionals	162	131 (80.86)	16 (9.88)	115 (70.99)
Service and sales workers	97	60 (61.86)	11 (11.34)	49 (50.52)
Craft workers and plant operators	992	862 (86.90)	118 (11.90)	744 (75.00)
Total	2221	1688 (76.00)	337 (15.17)	1351 (60.83)

Table: Vertical mismatch and size of firms

	Large firms				Small firms			
Occupations	Workers	No (share) of workers with vertical mismatch	No (share) of workers with over-education	No (share) of workers with under-education	Workers	No (share) of workers with vertical mismatch	No (share) of workers with over-education	No (share) of workers with under-education
Managers	683	447 (65.45)	155 (22.69)	292 (42.75)	265	178 (67.17)	35 (13.21)	143 (53.96)
Professionals	12	5 (41.67)		5 (41.67)	10	5 (50.00)	2 (20)	3 (30.00)
Technicians and associate professionals	78	58 (74.36)	7 (8.97)	51 (65.38)	84	73 (86.90)	9 (10.71)	64 (76.19)
Service and sales workers	43	14 (32.56)	6 (13.95)	8 (18.60)	54	46 (85.19)	5 (9.26)	41 (75.93)
Craft workers and plant operators	295	244 (82.71)	36 (12.20)	208 (70.51)	697	618 (88.67)	82 (11.76)	536 (76.90)
Total	1111	768 (69.13)	204 (18.36)	564 (50.77)	1110	920 (82.88)	133 (11.98)	787 (70.90)

Horizontal mismatch

Table: Desired education background of workers by firms

Occupations	Workers	Share of workers for which firms desired science background	Share of workers for which firms desired humanities background	Share of workers for which firms desired commerce background	Share of workers for which firms desired no specific background
Managers	948	231 (24.37)	15 (1.58)	92 (9.70)	610 (64.35)
Professionals	22	4 (18.18)	0 (0)	17 (77.27)	1 (4.55)
Technicians and associate professionals	162	64 (39.51)	1 (0.62)	4 (2.47)	93 (57.41)
Service and sales workers	97	6 (6.19)	2 (2.06)	8 (8.25)	81 (83.51)
Craft workers and plant operators	992	138 (13.91)	4 (0.40)	6 (0.60)	844 (85.08)
Total	2221	443 (19.95)	22 (0.99)	127 (5.72)	1629 (73.35)

Table: Actual education background of the workers

Occupations	Workers	Share of workers with science background	Share of workers with humanities background	Share of workers with commerce background	Share of workers with no specific background
Managers	948	208 (21.94)	156 (16.46)	42 (4.43)	542 (54.17)
Professionals	22	4 (18.18)	2 (9.09)	10 (45.45)	6 (27.27)
Technicians and associate professionals	162	15 (9.26)	28 (17.28)	2 (1.23)	117 (72.22)
Service and sales workers	97	6 (6.19)	24 (24.74)	3 (3.09)	64 (65.98)
Craft workers and plant operators	992	21 (2.12)	35 (3.53)	6 (0.60)	930 (93.75)
Total	2221	254 (11.44)	245 (11.03)	63 (2.84)	1659 (74.70)

Table: Incidence of horizontal mismatch

Occupations	Workers	Share of workers with horizontal mismatch	Share of workers with horizontal mismatch (large)	Share of workers with horizontal mismatch (small)
Managers	948	303 (31.96)	216 (22.78)	87 (9.18)
Professionals	22	8 (36.36)	4 (18.18)	4 (18.18)
Technicians and associate professionals	162	72 (44.44)	37 (22.84)	35 (21.60)
Service and sales workers	97	29 (29.90)	17 (17.53)	12 (12.37)
Craft workers and plant operators	992	178 (17.94)	66 (6.65)	112 (11.29)
Total	2221	590 (26.56)	340 (15.31)	250 (11.26)

Summary of the incidence of educational mismatch

- There is about 2 years gap between desired level of education and actual level of education
- There is an acute shortage of educated plant workers
- About three-fourth of the workers are subject to vertical mismatch. Under-education is more severe (60%).
- Incidence of under-education is the highest among the floor workers.
- Vertical mismatch is higher for the smaller firms (83% vs. 70%)
- Incidence of horizontal mismatch is low compared to vertical mismatch. It is about 27%.
- These low-tech firms do not have preferences over subject (76%)
- Incidence of horizontal mismatch is the highest for the technicians and associate professionals (44%).

Productivity and educational mismatch

- At two levels:
- Firm level (output per worker)

$$\log\left(\frac{Y}{L}\right) = \beta_0 + \beta_1 \textit{Vertical mismatch} + \beta_2 \textit{Occupation categories} + \beta_3 \textit{size of firm} + \beta_4 \log\left(\frac{K}{L}\right) + u$$
$$\log\left(\frac{Y}{L}\right) = \beta_0 + \beta_1 \textit{Horizontal mismatch} + \beta_2 \textit{Occupation categories} + \beta_3 \textit{size of firm} + \beta_4 \log\left(\frac{K}{L}\right) + u$$

- Firm-occupation level (monthly salary per occupation)

$\log(\textit{wages})$

$$= \gamma_0 + \gamma_1 \textit{Vertical mismatch} + \gamma_2 \textit{Occupation categories} + \gamma_3 \textit{Years of schooling} + \gamma_4 \textit{size of firm} + \gamma_5 \log\left(\frac{K}{L}\right) + u$$

$\log(\textit{wages})$

$$= \gamma_0 + \gamma_1 \textit{Horizontal mismatch} + \gamma_2 \textit{Occupation categories} + \gamma_3 \textit{Years of schooling} + \gamma_4 \textit{size of firm} + \gamma_5 \log\left(\frac{K}{L}\right) + u$$

Table: Vertical mismatch and output per worker

	(1)	(2)	(3)
VARIABLES	Model 1	Model 2	Model 3
Vertical mismatch	-0.411*** (0.107)	-0.189* (0.103)	-0.104 (0.097)
Professionals		-0.679** (0.308)	-0.664*** (0.250)
Technicians		-0.589*** (0.180)	-0.353** (0.159)
Service/sales workers		-0.494** (0.208)	-0.267 (0.182)
Plant workers		-0.929*** (0.125)	-0.629*** (0.111)
Total workers			0.003*** (0.001)
Log (K/L)			0.141*** (0.047)
Constant	14.507*** (0.124)	14.823*** (0.137)	12.608*** (0.595)
Observations	2,221	2,221	2,221
R-squared	0.021	0.148	0.278

Dependent variable: Log(Y/L)

Vertical mismatch: dummy variable, assumes 1 if actual level of education does not match desired level, 0 otherwise

Mismatch of education level does not seem to be associated with lower output per worker in a significant way!

Table: Over-education and output per worker

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Over-education	0.532*** (0.164)	0.393*** (0.144)	0.144 (0.117)
Professionals		-0.592* (0.322)	-0.625** (0.253)
Technicians		-0.572*** (0.175)	-0.355** (0.157)
Service/sales workers		-0.447** (0.212)	-0.251 (0.188)
Plant workers		-0.932*** (0.122)	-0.644*** (0.109)
Total workers			0.003*** (0.001)
Log (K/L)			0.136*** (0.047)
Constant	14.109*** (0.081)	14.614*** (0.111)	12.582*** (0.584)
Observations	2,221	2,221	2,221
R-squared	0.026	0.158	0.279

Dependent variable: Log(Y/L)

Over-education: dummy variable, assumes 1 if actual level of education is above the desired level, 0 otherwise

Over-education is not also sig. associated with lower output per worker when controlled for size of firms and technology (K/L).

Table: Under-education and output per worker

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Under-education	-0.604*** (0.119)	-0.379*** (0.109)	-0.170* (0.098)
Professionals		-0.676** (0.319)	-0.659** (0.256)
Technicians		-0.521*** (0.173)	-0.334** (0.158)
Service/sales workers		-0.468** (0.196)	-0.262 (0.179)
Plant workers		-0.858*** (0.121)	-0.614*** (0.110)
Total workers			0.003*** (0.001)
Log (K/L)			0.134*** (0.047)
Constant	14.561*** (0.123)	14.872*** (0.134)	12.731*** (0.605)
Observations	2,221	2,221	2,221
R-squared	0.061	0.166	0.281

Dependent variable: Log(Y/L)

Under-education: dummy variable, assumes 1 if actual level of education is below the desired level, 0 otherwise

However, under education is associated with lower output per worker significantly even controlling after size and technology!

Table: Under-education and output per worker (heterogeneity)

VARIABLES	Blue	White	Large	Small
Under-education	-0.241*	-0.039	-0.304**	0.110
	(0.131)	(0.116)	(0.128)	(0.076)
Professionals	-0.664**		-0.258	-0.409**
	(0.261)		(0.294)	(0.191)
Technicians	-0.325**		0.038	-0.321**
	(0.158)		(0.177)	(0.128)
Service/sales workers	-0.272		0.051	-0.159
	(0.172)		(0.168)	(0.170)
Plant workers			-0.057	-0.345***
			(0.126)	(0.087)
Total workers	0.002***	0.007***	0.001***	-0.017***
	(0.001)	(0.002)	(0.001)	(0.004)
Log (K/L)	0.170***	0.062	0.090	0.013
	(0.060)	(0.049)	(0.071)	(0.035)
Constant	12.317***	12.725***	13.864***	13.756***
	(0.776)	(0.596)	(0.930)	(0.464)
Observations	1,229	992	1,104	1,110
R-squared	0.238	0.146	0.163	0.125

Dependent variable: Log(Y/L)

The negative association between under-education and lower output per worker is driven by larger firms and for blue collar jobs.

Blue collar jobs: Technicians, plant workers

Table: Horizontal mismatch and output per worker

VARIABLES	Overall	Overall 1	Overall 2	Blue	White	Large	Small
Horizontal mismatch	0.358***	0.223**	0.178**	0.162*	0.163	0.197*	0.034
	(0.108)	(0.102)	(0.082)	(0.097)	(0.107)	(0.101)	(0.062)
Professionals		-0.648**	-0.650***	-0.647**		-0.260	-0.437**
		(0.318)	(0.249)	(0.251)		(0.283)	(0.204)
Technicians		-0.642***	-0.389**	-0.390**		-0.045	-0.300**
		(0.177)	(0.155)	(0.151)		(0.178)	(0.127)
Service/sales workers		-0.479**	-0.258	-0.266		0.124	-0.130
		(0.209)	(0.181)	(0.179)		(0.168)	(0.169)
Plant workers		-0.935***	-0.625***			-0.101	-0.316***
		(0.125)	(0.111)			(0.130)	(0.088)
Total workers			0.003***	0.002***	0.007***	0.002***	-0.017***
			(0.001)	(0.001)	(0.002)	(0.001)	(0.004)
Log (K/L)			0.141***	0.184***	0.062	0.103	0.008
			(0.046)	(0.058)	(0.049)	(0.068)	(0.035)
Constant	14.097***	14.625***	12.486***	11.956**	12.676**	13.478***	13.862***
			*	*			
	(0.085)	(0.119)	(0.577)	(0.723)	(0.582)	(0.870)	(0.454)
Observations	2,221	2,221	2,221	1,229	992	1,104	1,110
R-squared	0.018	0.151	0.281	0.233	0.149	0.151	0.121

Dependent variable: Log(Y/L)

Horizontal mismatch: dummy, assumes 1 if actual field of study does not match with the desired one, 0 otherwise

Horizontal mismatch is associated with higher output per worker!

Table: Vertical mismatch and wages [dep. variable: log(wages)]

	(1)	(2)	(3)	White	Blue	Large	Small
Vertical mismatch	-0.028						
	(0.020)						
Over-education		0.091***					
		(0.020)					
Under-education			-0.081***	0.006**	-0.163***	-0.100***	-0.063**
			(0.025)	(0.003)	(0.035)	(0.029)	(0.031)
Average education	-0.024***	-0.026***	-0.030***	0.003***	-0.044***	-0.023***	-0.031***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.005)	(0.005)	(0.003)
Total workers	0.000***	0.000***	0.000***	-0.000***	0.000***	0.000***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Log(K/L)	0.028***	0.025***	0.025***	0.000	0.040***	0.024***	0.006
	(0.007)	(0.007)	(0.006)	(0.001)	(0.010)	(0.007)	(0.010)
Constant	11.521***	11.546***	11.642***	10.527***	11.610***	11.700***	11.647***
	(0.091)	(0.089)	(0.091)	(0.019)	(0.146)	(0.106)	(0.148)
Observations	2,221	2,221	2,221	992	1,229	1,104	1,110
R-squared	0.833	0.835	0.836	0.128	0.734	0.894	0.690

Table: Horizontal mismatch and wages

[dep. variable: log(wages)]

		White	Blue	Large	Small
Horizontal mismatch	-0.052*** (0.019)	0.004 (0.002)	-0.086*** (0.029)	-0.028 (0.020)	-0.084*** (0.027)
Average education	-0.022*** (0.003)	0.002*** (0.001)	-0.031*** (0.004)	-0.015*** (0.003)	-0.025*** (0.004)
Total workers	0.000*** (0.000)	-0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.001 (0.001)
Log(K/L)	0.028*** (0.007)	-0.000 (0.001)	0.047*** (0.011)	0.027*** (0.007)	0.008 (0.010)
Constant	11.492*** (0.089)	10.537*** (0.019)	11.339*** (0.142)	11.538*** (0.101)	11.562*** (0.149)
Observations	2,221	992	1,229	1,104	1,110
R-squared	0.834	0.124	0.727	0.891	0.692

Summary of regression results

- If the workers' level of education is below the desired level by the employers (i.e. under-education), it is negatively associated with the output per worker of the firms.
- Under-education affects output per worker more severely in larger firms.
- Mismatch in field of education has been found to be positively associated with output per worker! [puzzling]
- Employers reward over-educated workers with higher wages and punish under-educated workers with lower wages.
- The punishment for under-education is greater for larger firms and blue collar jobs.
- Employers also punish workers with horizontal mismatch with lower wages.
- This punishment is more severe for smaller firms and blue collar jobs.

Conclusion and policy implications

- First study on the impact of educational mismatch on labor productivity and wages in developing country context.
- Under-education is more severe than over-education, unlike developed countries.
- Even in low tech setting, level of education of the workers below the desired level can lower output per worker.

- Why firms are hiring under-educated workers? Why market is not correcting this problem?
- What role government can play?
- Can training be a substitute for formal education?
- Another BIDS study shows that it can to some extent!
- Skill development programs should not be implemented in isolation → should be a part of overall human capital development strategy.

Thank You