

Table 1 Sample Size and Percent of Firms
Providing Formal Training by Industry and Firm Size—1988, 1994, 1996

Industry	Number of Observations			Percent Formal Training		
	1988	1994	1996	1988	1994	1996
Food & Beverages	518	399	308	26.25	28.57	39.61
Textiles & Apparel	199	209	174	38.69	34.45	48.28
Wood & Wood Products	234	219	151	20.09	30.14	36.42
Furniture	68	69	76	29.41	26.09	39.47
Paper & Printing	150	126	119	39.33	34.92	52.94
Chemicals & Petroleum	383	339	254	40.99	50.15	65.35
Glass & Ceramics	143	129	95	25.87	44.19	47.37
Basic Metals	71	57	46	29.58	45.61	60.87
Fabricated Metals	141	116	104	39.01	40.52	48.08
General Machinery	121	87	78	28.93	34.48	43.59
Electrical Machinery	138	208	136	63.04	64.42	84.56
Transport Equipment	78	74	47	42.31	50.00	63.83
Other Industry n.e.c.	64	58	65	37.50	58.62	50.77
<u>Firm Size</u>						
Small—Less than 100	1614	1159	894	24.35	25.54	35.12
Medium—100-249	433	535	437	49.88	51.78	63.62
Large—250+	261	396	322	68.58	69.7	81.68
Total	2308	2090	1653	34.14	40.62	51.72

Table 2 Percent of Firms Providing Formal Training
by Firm Size and Status of HRDF Registration—1988, 1994, and 1996

Firm Size	1988	1994	1996	1994		1996	
				HRDF=0	HRDF=1	HRDF=0	HRDF=1
Small	35.03	39.44	49.10	32.49	46.43	34.54	63.31
Medium	49.88	51.77	63.62	37.06	57.14	33.88	75.00
Large	68.58	69.70	81.68	44.00	71.43	34.21	88.03
Total	47.23	53.47	64.50	35.07	60.48	34.26	77.24

Note: HRDF = 1 indicates registration with the HRDF and payment of training levies, while HRDF = 0 indicates not-registered with HRDF.

Table 3 Percent of Firms Providing Formal Training
by Firm Size and Type of New Technology Used—1988, 1994, and 1996

Firm Size	1988		1994		1996	
	TEC=0	TEC=1	TEC=0	TEC=1	TEC=0	TEC=1
A. New technology						
Small	19.49	41.34	18.25	42.53	29.22	61.21
Medium	43.44	58.20	41.18	62.74	57.29	75.00
Large	59.57	73.65	59.83	73.83	73.25	91.33
Total	25.52	53.36	27.50	58.31	42.30	75.37
B. Process IT						
Small	24.36	22.22	24.51	51.11	31.58	64.58
Medium	49.88	50.00	48.75	78.18	57.44	84.16
Large	68.46	70.00	68.19	76.81	71.51	94.41
Total	33.81	48.08	38.00	70.41	43.64	82.94

Note: TEC equals 0 or 1 indicates use of each type of new technology, where:

- A. New technology = introduction of new product/process technology in previous 3 years
- B. Process IT = use of one or more of 5 types of IT for production process functions.

Table 4 Random Effects Probit Estimates
Probability of Formal Training—1988, 1994, and 1996

Dep. variable: $P(\text{train})_{it}$ Explanatory variables:	Model 1		Model 2	
	Coef.	z-stat	Coef.	z-stat
Introduced new technology	0.5555	12.74	--	--
Use advanced process IT	--	--	0.4839	6.14
Registered with HRDF	0.6346	11.15	0.6111	10.78
Medium size firm	0.4094	7.71	0.4555	8.62
Large size firm	0.7386	10.57	0.8271	11.88
Proportion highly skilled	1.0244	7.49	0.9906	7.26
Proportion skilled production	-0.0046	-0.06	-0.0258	-0.35
Union indicator variable	0.3102	5.87	0.3140	5.97
Export indicator variable	0.1521	3.31	0.2223	4.88
1994 indicator variable	-0.2675	-4.90	-0.2138	-3.90
1996 indicator variable	0.1837	3.14	0.1199	1.86
Constant term	-1.0995	-8.52	-0.9976	-7.63
Log-likelihood	-3281.7		-3347.8	
Total observations	6,052		6,052	
Total firms	3,703		3,703	

Note: Model includes missing indicator variables for IT, skills, and union status, as well as indicator variables for 12 industrial sectors

Table 5 Actual and Predicted Probabilities of Training
And Simulations With HRDF and TEC—1988, 1994, and 1996

<u>Simulations</u>	Actual and predicted training			Change relative to Baseline		
	1988	1994	1996	1988	1994	1996
<u>Firm size</u>						
<u>Small size Firms</u>						
Actual probability	35.0	39.4	49.1	24.2	22.2	34.2
Predicted baseline	24.2	22.2	34.2	0	0	0
HRDF=0	24.2	16.9	28.2	0	5.2	6.0
TEC=0	20.1	17.2	30.5	4.1	5.0	3.7
HRDF=0 TEC=0	20.1	12.4	24.5	4.1	9.7	9.7
<u>Medium size firms</u>						
Actual probability	49.9	51.8	63.6	47.1	53.1	65.9
Predicted baseline	47.1	53.1	65.9	0	0	0
HRDF=0	47.1	36.3	50.3	0	16.8	15.3
TEC=0	37.9	43.5	59.9	9.1	9.6	6.1
HRDF=0 TEC=0	37.9	26.5	42.8	9.1	26.6	23.2
<u>Large size firms</u>						
Actual probability	68.6	69.7	81.7	65.2	74.8	82.0
Predicted baseline	65.2	74.8	82.0	0	0	0
HRDF=0	65.2	55.1	66.7	0	19.7	15.3
TEC=0	52.4	62.8	76.5	12.8	12.0	5.5
HRDF=0 TEC=0	52.4	40.2	57.9	12.8	33.6	24.0

Note: simulations based upon probit parameters reported in Table 14.

Table 6 Production Function Estimates with Predicted Training
And Whether Introduced New Technology Recently

Dependent variable: Log(real value added)	<u>All Firms</u>		Recently Introduced New Technology?			
	Explanatory variables	Coef.	z-stat	<u>No</u>		<u>Yes</u>
Coef.				z-stat	Coef.	z-stat
<u>Production Function</u>						
Log(capital assets)	0.3042	32.51	0.2954	26.49	0.3268	19.88
Log(skill group 1)	0.4035	25.64	0.3962	19.09	0.4023	15.67
Log(skill group 2)	0.1237	16.13	0.1437	13.82	0.0867	8.04
Log(skill group 3)	0.0435	6.66	0.0529	5.81	0.0292	3.20
Log(skill group 4)	0.0757	11.73	0.0865	9.94	0.0465	5.12
<u>Training Measure</u>						
Predicted training (sample mean) ¹	0.7106 (0.4066)	9.50	0.7704 (0.3006)	5.97	0.8211 (0.6097)	5.45
<u>Ownership & Time</u>						
Joint ventures	0.1142	3.22	0.1476	3.28	0.1149	2.21
Foreign owned firms	0.1947	5.15	0.2541	5.14	0.1528	2.96
1994 dummy	0.0728	3.55	0.0761	2.68	0.0658	1.97
1996 dummy	-0.0124	-0.50	-0.0511	-1.48	0.0101	0.21
<u>Industry dummies</u>						
Food & beverages	0.5035	6.21	0.4681	4.61	0.6582	5.79
Textiles & apparel	0.3005	3.45	0.2664	2.45	0.3463	2.82
Wood products	0.6540	7.49	0.6474	5.97	0.6281	4.94
Furniture	0.3899	3.93	0.3101	2.47	0.4779	3.41
Paper & printing	0.5462	6.00	0.5202	4.62	0.5975	4.74
Chemicals & rubber	0.4812	5.93	0.4453	4.35	0.5446	4.89
Glass & ceramics	0.2374	2.56	0.2058	1.83	0.3278	2.39
Basic metals	0.2854	2.66	0.2545	1.94	0.3441	2.20
Fabricated metals	0.3017	3.33	0.2996	2.66	0.2478	1.92
General machinery	0.2746	2.67	0.3257	2.42	0.3119	2.26
Electrical machinery	0.2969	3.35	0.1813	1.51	0.3495	3.04
Transport equipment	0.3144	2.85	0.3760	2.77	0.2557	1.71
Constant term	7.9561	61.81	8.0180	51.88	7.7299	35.54
Total observations	5,618		3,640		1,978	
Number of firms	3,468		2,614		1,563	
Overall R ²	0.7896		0.7607		0.7811	

Note: ¹ sample means of training probabilities predicted using model 1 are enclosed in parentheses. See Table 4.

Table 7 Production Function Estimates with Training
By Firm Size and By Number of Training Episodes

Dependent variable: Log(value added)	Small Firms		Medium & Large Firms		Balanced Panel Training Episodes	
Explanatory variables	Coef.	z-stat	Coef.	z-stat	Coef.	z-stat
Production Function						
Log(capital assets)	0.2575	22.25	0.3558	22.00	0.2942	16.67
Log(skill group 1)	0.4289	19.85	0.3216	14.42	0.4444	16.33
Log(skill group 2)	0.1823	14.74	0.0743	7.73	0.1062	7.79
Log(skill group 3)	0.0851	7.41	0.0091	1.19	0.0316	2.86
Log(skill group 4)	0.1212	11.35	0.0289	3.52	0.0673	6.17
Training Measures						
Predicted training (sample means) ¹	0.8731 (0.2601)	7.54	0.6283 (0.6320)	5.66	--	--
1 Training episode	--	--	--	--	0.0908	1.38
2 Training episodes	--	--	--	--	0.2668	3.26
3 Training episodes	--	--	--	--	0.3158	3.05
Ownership & Time						
Joint ventures	0.1191	2.31	0.0530	1.18	0.0638	1.05
Foreign owned firms	0.3737	6.05	0.0556	1.26	0.1809	2.26
1994 dummy	0.1328	4.98	-0.0187	-0.56	0.1522	4.88
1996 dummy	-0.0108	-0.33	-0.0405	-1.03	0.0898	2.76
Industry dummies						
Food & beverages	0.5291	4.82	0.6151	5.48	0.2156	1.25
Textiles & apparel	0.3488	2.83	0.2040	1.85	0.0085	-0.04
Wood products	0.6637	5.53	0.5378	4.69	0.2636	1.46
Furniture	0.4210	3.17	0.2300	1.71	0.3433	1.58
Paper & printing	0.6089	4.98	0.3586	2.91	0.3219	1.68
Chemicals & rubber	0.5355	4.75	0.2955	2.82	0.4221	2.43
Glass & ceramics	0.2825	2.28	0.1801	1.39	0.0077	0.04
Basic metals	0.3642	2.49	0.1689	1.19	0.1507	0.60
Fabricated metals	0.3808	3.13	0.0655	0.52	0.0269	0.13
General machinery	0.2268	1.65	0.3028	2.10	0.1166	0.53
Electrical machinery	0.2215	1.51	0.3052	2.89	0.3631	1.81
Transport equipment	0.2986	2.03	0.3038	2.06	0.1947	0.93
Constant term	8.1769	49.69	8.0959	35.86	8.4661	33.16
Total observations	3,359		2,259		1,824	
Number of firms	2,212		1,475		608	
Overall R ²	0.6604		0.6468		0.7973	

Note: ¹ sample means of training probabilities predicted using model 1 are enclosed in parentheses. See Table 4.

REFERENCES

Ann Bartel and Frank Lichtenberg, "The Comparative Advantage of Educated Workers in Implementing New Technology", Review of Economics and Statistics, February 1987, Volume LXIX, 1, pp. 1-11.

Eli Berman, John Bound and Stephen Machin, "Implications of Skill-Biased Technological Change: International Evidence", Centre for Economic Performance, London School of Economics, September 1997.

Amit Dar, Sudarshan Canagarajah and Paud Murphy, "Training Levies: Rationale and Evidence from Evaluations", The World Bank, November 2000.

S. Machin, A. Ryan and J. Van Reenan, "Technology and Changes in Skill Structure: Evidence from an International Panel of Industries", Center for Economic Performance, Discussion Paper No. 297, London School of Economics, June 1996.

Hong Tan and Geeta Batra, Enterprise Training in Developing Countries: Incidence, Productivity Effects, and Policy Implications, PSD Book, The World Bank, 1995.

Hong Tan and Indermit Gill, "Vocational Education and Training in Malaysia", in Indermit Gill, Fred Fluitman and Amit Dar (eds.), Skills and Change: Constraints and Innovation in the Reform of Vocational Education and Training, World Bank-ILO, Oxford University Press, 2000.

Hong Tan, Technology and Skill Needs in Malaysian Manufacturing, PSD Report to the Economic Planning Unit (Government of Malaysia), The World Bank, 2000.

World Bank, Malaysia: Enterprise Training, Technology and Productivity, World Bank Country Study, The World Bank, 1997.