

Are there any returns to firm-sponsored training? Productivity and beyond.

Benoit Dostie

Institute of Applied Economics, HEC Montréal

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Motivation

- 1 Firms as well as governments invest considerable resources in training.

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- 1 Firms as well as governments invest considerable resources in training.
- 2 There is no agreement amongst economists as to whether, and to what extent, training has a bearing on firm-level productivity.

Micro with objective measures of productivity

- 1 Holzer, Block, Cheatham & Knott (ILRR:1993)
- 2 Bartel (Industrial Relations:1994)
- 3 Black & Lynch (AER:1996 & RESTAT:2001)
- 4 Barrett & O'Connell (ILRR:2001)
- 5 Ballot, Fakhfakh & Taymas (Labour Economics:2001)
- 6 Zwick (Industrial Relations:2006)
- 7 Dostie & Pelletier (CPP:2007)

Small samples and data problems

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- 1 Holzer & al (Industrial Relations:1993): 390 applicants to the Michigan Job Opportunity Bank-Upgrade between 1987-1989
- 2 Bartel (Industrial Relations:1994): Own survey covering 495 firms with no measure of the intensity of training
- 3 Ballot & al (Labour Economics:2001): 90 firms in France and 270 firms in Sweden

Methodology problems

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 - Barrett & O'Connell (ILRR:2001)
- 2 Black & Lynch (AER:2001) only control for endogeneity due to time-invariant variables
- 3 Zwick (Industrial Relations:2006) and Dostie & Pelletier (CPP:2007) use possibly weak IVs

Results all over the place

- 1 No impact or deferred impact
 - Bartel (Industrial Relations:1994)
 - Black & Lynch (RESTAT:2001)

Results all over the place

- ② Positive impact (but hard to quantify)
 - Holzer & al (ILRR:1993)
 - Black & Lynch (AER:1996)
 - Ballot & al (Labour Economics:2001)

Results all over the place

- ③ Positive effect of general (classroom) training but not for specific (on-the-job) training
 - Black & Lynch (AER:1996)
 - Barrett & O'Connell (ILRR:2001)
 - Dostie & Pelletier (CPP:2007)

- ④ Few estimates of the magnitude of the impact: Zwick (Industrial Relations:2006) finds that increasing the intensity of training by one percentage point increased average establishment productivity by 0.76 percentage point

Most recent study: Dostie & Pelletier (CPP:2007)

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- 1 DATA: WES 1999-2002
- 2 FINDINGS: higher returns to classroom training than on-the-job training
- 3 LIMITS: weak IVs

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- 3 Expands Dostie & Pelletier's performance measures, going beyond productivity

Linked Employer-Employee Data

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- 2 Abowd and Kramarz (1999) classify WES as a survey in which both the sample of workplaces and the sample of workers are cross-sectionally representative of the target population

Survey design

Table: Survey Design

Year	Workplaces	Workers
1999	6,322	23,540
2000	6,068	20,167
2001	6,207	20,352
2002	5,818	16,813
2003	6,565	20,834
2004	6,159	16,804

Survey Design

Table: Sample

	Number of groups	Observations per Group
Workplaces	7,783	14.4
Workers	59,910	1.9

Cobb-Douglas

$$\ln Q_{jt} = \beta_L \ln L^E_{jt} + \beta_K \ln K_{jt} + \gamma Z_{jt} + \epsilon_{jt}. \quad (1)$$

$$L^E_{jt} = \lambda_T L^T_{jt} + \lambda_{NT} L^{NT}_{jt} \quad (2)$$

$$= \lambda_{NT} L_{jt} + (\lambda_T - \lambda_{NT}) L^T_{jt} \quad (3)$$

$$\ln L^E_{jt} = \ln \lambda_{NT} + \ln L_{jt} + \ln \left(1 + \left(\frac{\lambda_T}{\lambda_{NT}} - 1 \right) P_{jt} \right) \quad (4)$$

Cobb-Douglas

$$\ln Q_{jt} \simeq \beta_0 + \beta_L \ln L_{jt} + \beta_K \ln K_{jt} + \beta_L \kappa P_{jt} + \gamma Z_{jt} + \epsilon_{jt} \quad (5)$$

$$\epsilon_{jt} = \omega_{jt} + \psi_j + \eta_{jt} \quad (6)$$

GMM

$$\omega_{jt} = \alpha \omega_{jt-1} + \mathbf{e}_{jt} \quad (7)$$

$$\begin{aligned} \ln Q_{jt} = & \alpha \ln Q_{j,t-1} + \beta_K \ln K_{jt} - \alpha \beta_K \ln K_{jt-1} + \beta_L \ln L_{jt} - \alpha \beta_L \ln L_{jt-1} \\ & + \beta_L \kappa P_{jt} - \alpha \beta_L \kappa P_{jt} + \gamma Z_{jt} - \alpha \gamma Z_{jt-1} \\ & + (\psi_j(1 - \alpha) + \mathbf{e}_{jt} + \eta_{jt} - \alpha \eta_{jt}) \end{aligned} \quad (8)$$

GMM

$$\begin{aligned} \ln Q_{jt} = & \pi_1 \ln Q_{jt-1} + \pi_2 K_{jt} + \pi_3 K_{jt-1} + \pi_4 L_{jt} + \pi_5 L_{jt-1} + \\ & + \pi_6 P_{jt} + \pi_7 P_{jt-1} + \pi_8 Z_{jt} + \pi_9 Z_{jt-1} + \\ & + \gamma_t^* + (\psi_j^* + \eta_{jt}^*) \end{aligned} \quad (9)$$

$$\begin{aligned} \pi_3 &= -\pi_2 \pi_1 \\ \pi_5 &= -\pi_4 \pi_1 \\ \pi_7 &= -\pi_6 \pi_1 \\ \pi_9 &= -\pi_8 \pi_1 \end{aligned} \quad (10)$$

Value added per employee

Table: Coefficient estimates - production function

	OLS		
prop - classroom	0.124 (0.047)		0.125 (0.057)
prop - on-the-job		0.030 (0.013)	-0.002 (0.026)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations	30567	30567	30567
R-squared	0.59	0.59	0.59
Number of workplaces	7310	7310	7310

Value added per employee

Table: Coefficient estimates - production function

	FE		
prop - classroom	0.051**		0.050**
	(0.024)		(0.025)
prop - on-the-job		0.010	0.004
		(0.016)	(0.017)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations	30567	30567	30567
Number of workplaces	7310	7310	7310

Value added per employee

Table: Coefficient estimates - production function

	B&B		
prop - classroom	0.049 (0.034)		0.062 (0.041)
prop - on-the-job		-0.007 (0.004)	-0.007 (0.004)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations	22879	22879	22879
Number of workplaces	6684	6684	6684

Subjective Measures of Performance

Table: Summary statistics - Subjective performance

	Incr.	Same	Decr.
Unit production cost	42.66	49.63	7.71
Productivity	37.08	55.39	7.53
Sales growth	44.56	37.45	17.99
Product Quality	29.61	69.28	1.11
Customer Satisfaction	33.88	64.58	1.53
Profitability	34.59	64.58	1.53

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Unit production cost		
	Incr.	Same	Decr.
prop - classroom	0.013 (0.011)	-0.008 (0.007)	-0.004 (0.004)
prop - on-the-job	0.006 (0.005)	-0.004 (0.003)	-0.002 (0.002)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Productivity		
	Incr.	Same	Decr.
prop - classroom	0.021 (0.014)	-0.014 (0.009)	-0.007 (0.005)
prop - on-the-job	0.029*** (0.008)	-0.019*** (0.005)	-0.010*** (0.003)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Sales growth		
	Incr.	Same	Decr.
prop - classroom	0.006 (0.009)	-0.002 (0.003)	-0.004 (0.006)
prop - on-the-job	0.021*** (0.006)	-0.007*** (0.002)	-0.013*** (0.004)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Product Quality		
	Incr.	Same	Decr.
prop - classroom	0.033*** (0.012)	-0.031*** (0.012)	-0.002*** (0.001)
prop - on-the-job	0.014** (0.006)	-0.013** (0.005)	-0.001** (0.000)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Customer Satisfaction		
	Incr.	Same	Decr.
prop - classroom	0.013** (0.006)	-0.012** (0.006)	-0.001** (0.001)
prop - on-the-job	0.036*** (0.002)	-0.033*** (0.002)	-0.003*** (0.000)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Subjective Measures of Performance

Table: Marginal effect - ordered probit

	Profitability		
	Incr.	Same	Decr.
prop - classroom	0.007*** (0.002)	-0.002*** (0.000)	-0.006*** (0.001)
prop - on-the-job	0.017*** (0.004)	-0.004*** (0.001)	-0.013*** (0.003)
Controls for			
workplace practices	YES	YES	YES
industry	YES	YES	YES
year	YES	YES	YES
Observations		30567	
Number of workplaces		7310	

Innovation

Table: Summary statistics - Innovation

	YES (%)
Improved processes	23.47
Improved products	31.67
New processes	18.61
New products	26.63

Table: Marginal effects - innovation probit

	Impv prc	Impv prd
prop - classroom	0.025*** (0.004)	0.054*** (0.003)
prop - on-the-job	0.076*** (0.007)	0.060*** (0.009)
Controls for		
workplace practices	YES	YES
industry	YES	YES
year	YES	YES
Observations	30567	
Number of workplaces	7310	

Innovation

Table: Marginal effects - innovation probit

	New prc	New prd
prop - classroom	0.028*** (0.010)	0.046*** (0.014)
prop - on-the-job	0.051*** (0.003)	0.053*** (0.008)
Controls for		
workplace practices	YES	YES
industry	YES	YES
year	YES	YES
Observations	30567	
Number of workplaces	7310	

Training leads to higher productivity

Summing up

- ① Employee who undertook some classroom training are 10% more productive than other employees

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- 1 Employee who undertook some classroom training are 10% more productive than other employees
- 2 ROI: 100% returns
- 3 Impact of training goes beyond productivity, especially innovation
- 4 What's up with on-the-job training?