Multi-Layer Profit Sharing and Innovation

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Multi-layer profit sharing

- PS widely used worldwide to boost short-run productivity
  - 62% of firms in the US (NBER, 2010) and 30.2% in EU (EC, 2014)
  - rarely covers the workers in a firm all together

THE WALL STREET JOURNAL.
SATURDAY, FEBRUARY 19, 2011

Citi Sets Up Profit-Share Plan

Citigroup Inc. instituted a new profit-sharing plan for a few dozen top executives, giving them a small share of the company's profits over the next two years.

Citigroup said the plan, which could award four top executives more than $11.9 million based on results in 2011 and 2012, "further aligns compensation with the long-term performance of Citi."

### THE WALL STREET JOURNAL.
MONDAY, MARCH 28, 2016

American Airlines Reverses Course on Employee Profit-Sharing

American Airlines Group Inc., which hasn't allowed employee profit-sharing in new labor contracts reached since its late 2013 merger with US Airways, changed course Wednesday and said it would offer a program that would pay 5% of pretax profits to all but management employees based on this year's earnings.

This paper

- ▶ Has PS an effect on innovation? Does this differ across firm layers?
  - ▶ if PS is based on short-run profits, long-run effects are not obvious
  - ▶ managers and non-managers may have different behaviours under PS
  - ▶ previous literature is silent on both questions literature

- ▶ Why it is important the model
  - ▶ motivating employees to exert innovative efforts is a challenge for firms
  - ▶ optimal pay contracts may be fundamentally different across layers

- ▶ In this paper
  - ▶ EES-INAPP data (2009-2014): panel of $\sim$ 10000 Italian firms
  - ▶ PS as cash bonus based on yearly profits (favourability principle)

Motivation
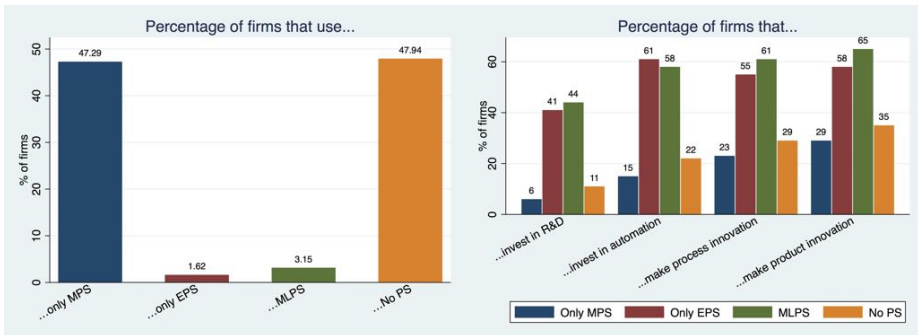
EES-INAPP data (2009-2014)

Legend:
- only MPS: PS for managers only (executives/non-executive managers)
- only EPS: PS for non-managers only (non-managerial supervisors, white/blue-collars)
- MLPS: PS at both layers
- no PS: PS not used an any layer

Baseline regression

$$\overbrace{\text{Innovation}_{f,w}}^{\text{in 2012-14}} = \beta_0 + \overbrace{\beta_1\,\text{MPS}_{f,w-1} + \beta_2\,\text{EPS}_{f,w-1} + \mathbf{b}\mathbf{X}_{f,w-1}}^{\text{in 2009}} +$$
$$\text{sector FE}_{f,w} + \text{region FE}_{f,w} + \varepsilon_{f,w} \qquad (1)$$

$\mathbf{X}_{f,w-1}$ (2009): individual-based PRP, investments in R&D and automation, voluntary separations, workforce and CEO controls (education, age, gender), family ownership, company type, span of control, multi-firm group, exporting firm, unionization, # employees, revenues, years since incorporation

▶ Why endogeneity is not a (big) concern
  ▶ reverse causality: past innovation under-performance does not correlate with new PS adoption (anyway it would cause downward bias)
  ▶ worker sorting: PS does not correlate with average wage (anyway worse workers would be those attracted by PS: downward bias again)

Baseline results

	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN.	[4] THE FIRM MAKES ANY INN.	[5] THE FIRM MAKES ANY INN.	[6] THE FIRM MAKES ANY INN.
MPS	0.008	0.008	0.011	0.011	-0.014	0.012
	(0.012)	(0.012)	(0.012)	(0.012)	(0.022)	(0.022)
EPS	0.082***	0.061**	0.058**	0.055**	0.086**	0.112**
	(0.027)	(0.027)	(0.027)	(0.021)	(0.043)	(0.053)
Individual-based PRP	-0.034	-0.044	-0.040	-0.049*	-0.025	-0.017
	(0.031)	(0.031)	(0.031)	(0.029)	(0.055)	(0.066)
Investments in R&D	NO	0.165***	NO	NO	NO	NO
		(0.017)				
Investments in automation	NO	NO	0.108***	NO	NO	NO
			(0.012)			
Innovation in 2007-09	NO	NO	NO	0.215***	NO	NO
				(0.009)		
Other firm-level controls	YES	YES	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15	2010/15	2010/15
Innovation over 2004–2006	ANY	ANY	ANY	ANY	=0	=1
# of obs.	7051	7018	7018	7051	2461	1759
Estimation	LOGIT	LOGIT	LOGIT	LOGIT	LOGIT	LOGIT

Multi-layering

▶ Run:

Innovation$_{f,w} = \beta_0 + \beta_1$ Only MPS$_{f,w-1} + \beta_2$ Only EPS$_{f,w-1} +$
$$\beta_3 \text{ MLPS}_{f,w-1} + \mathbf{bX}_{f,w-1} +$$
$$\text{sector FE}_{f,w} + \text{region FE}_{f,w} + \varepsilon_{f,w} \qquad (2)$$

▶ and χ^2-test against the null that H_0: $\beta_3 - \beta_2 = 0$

▶ Endogeneity: sample split based on MPS=0/1 in 2009 and IV for EPS by sectoral share of firms adhering to II-level agreements in 2006

Effects of multi-layer PS

	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN. MPS=0	[4] THE FIRM MAKES ANY INN. MPS=1
Only MPS	0.005	0.009		
	(0.012)	(0.012)		
(β_2) Only EPS	0.077**	0.053*		
	(0.031)	(0.030)		
(β_3) MLPS	0.102***	0.066*		
	(0.037)	(0.036)		
EPS (instrumented)			4.054***	2.763*
			(0.415)	(1.521)
H_0: $\beta_3 - \beta_2 = 0$ [p-value]	[0.577]	[0.750]		
Individual-based PRP	-0.038	-0.050*	-1.441***	-0.950*
	(0.031)	(0.029)	(0.153)	(0.517)
Innovation in 2007-09	NO	0.212***	0.309***	0.516***
		(0.009)	(0.118)	(0.139)
Other firm-level controls	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15
# of obs.	7379	7379	4248	3180
Estimation	LOGIT	LOGIT	IV-LOGIT	IV-LOGIT
			FIRST-STAGE	
II-level agreements in 2006 (sector avg.)			0.353***	0.339***
			(0.068)	(0.070)

Additional checks

- Linear MPS and EPS effects
    - Alternative extensions of layers `alternative layers`
    - Disentangling process/product innovation `prod/proc innovation`
    - Propensity score matching `psm`
- Multi-layering
    - Alternative specifications `interactions`
    - Disentangling process/product innovation `ML prod/proc innovation`

Conditional marginal effects

▶ Measure the conditional margins of EPS as

$$\frac{\partial \Pr(\text{Innovation}_{f,w} = 1)}{\partial \text{EPS}_{f,w-1}} = \frac{e^{\beta x}}{(1 + e^{\beta x})^2} \frac{\partial (\beta x)}{\partial \text{EPS}_{f,w-1}}$$

$$\text{at } [\text{MPS}_{f,w-1} = (0\ 1)|\,C_{f,w-1}, E(\mathbf{X}_{f,w-1})]$$

with $C_{f,w-1}$ = each of a set of firm characteristics

▶ Main results: EPS effects change across firm features `graphs`
  - ▶ decrease if size is 2000+ employees (1/N problem) `1/N`
  - ▶ are zero when unionization > 50%
  - ▶ decrease if non-managers per manager are 500+
  - ▶ are 10% higher for exporters
  - ▶ are lower when the workforce is older and more educated

Conclusions

▶ First paper measuring PS effects on innovation along firm hierarchy

▶ Take-away message: the optimal contracts that motivate innovation may be fundamentally different across different layers
  ▶ short-run PS has no effect when used for managers
  ▶ but it works well when used for non-managers: Pr(Inn) ↑ by 5%-15%
  ▶ many moderating factors (unions, workforce characteristics, exporting)

▶ Policy implications
  ▶ for business strategists: different compensation schemes across layers
  ▶ for legal policy-makers: improve tax exemptions on company-wide cash bonuses for non-managers

Thank you!

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Related literatures

- Long versus short-term pay
  - more innovation if CEOs are rewarded based on long-term pay (Hothausen et al., 1995 JAE; Lerner and Wulf, 2007 RES; Manso, 2011 JF; Ederer and Manso, 2013 MS) and if so are paid also non-executive employees (Chang et al., 2015 JFE)

- Group versus individual-based pay
  - group incentive pay promotes teamwork (Fitzroy and Kraft, 1987 QJE), productivity (Doucouliagos et al., 2019 BJIR) and innovation on average (Aerts et al, 2015 ICC) but suffers from free-riding (Drago and Garvey, 1998 JLE)

- Dearth of evidence on how...
  - short-run PS at each firm layer influences innovation
  - PS of managers affects the power of incentives of non-managers
  - these effects are moderated by the span of control and free-riding

back

Framework
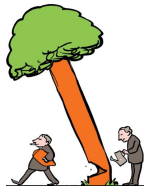
- ▶ The basic idea

    - ▶ innovation projects require the firm to perform poorly today
        - ▶ but allow it to gain greater profits tomorrow

    - ▶ managers have outside options whose value depends on early profits
        - ▶ non-managers don't

    - ▶ under PS, managers may want more profits today than non-managers
        - ▶ locked-in non-managers may want postponing profits (innovation)

    - ▶ managers may push non-managers to take conservative strategies
        - ▶ if have the power to do so

    - ▶ under fixed pay, innovation is sub-optimal for both types of agent

Framework / cont'd

▶ Agent $i \in \{M, E\}$ can take action $j \in \{D, S\}$ (one or both)
  ▶ D costs $c_i^D = 0$, generates $\tau \pi^D$ in t_1 and $(1-\tau)\pi^D$ in t_2
  ▶ S costs $c_i^S > 0$, generates 0 in t_1 and π^S in t_2, with $\pi^S > \pi^D$
  ▶ S is not contractible and expected to succeed by $\mathbb{E}_i[p^S]$

▶ and obtains

$$
U_i^j = \begin{cases} \tau \pi^D + \frac{(1-\tau)\pi^D}{1+\delta_i} & \text{if } j = D \\[3mm] -c_i^S + \tau \pi^D + \overbrace{\frac{\mathbb{E}_i[p^S]\Delta\pi\alpha_i + (1-\tau)\pi^D}{1+\delta_i}}^{\text{with PS}} & \text{if } j = S \end{cases}
$$

  where $\Delta\pi \equiv \pi^j - \overline{\pi}$ and $\pi^D = \overline{\pi}$

▶ PS at layer i influences incentives to innovate of agent i
  ▶ with PS, S is taken if $\delta_i < \frac{\mathbb{E}_i[p^S]\Delta\pi\alpha_i - c_i^S}{c_i^S} \equiv \overline{\delta_i}$

Framework / cont'd

- ▶ PS at layer E may also influence incentives to innovate of agent M
  - ▶ suppose that agents can leave after t_1, with E having no outside option and M receiving

  $$\omega_{Mt1} = \begin{cases} \frac{2\tau\pi^D}{1+\delta_M} & \text{if } j = D \text{ for both agents} \\ \frac{2\tau\pi^D - c_M - c_E}{1+\delta_M} & \text{if } j = S \text{ for both agents} \\ \frac{2\tau\pi^D - c_M}{1+\delta_M} & \text{if } j = S \text{ for } M \text{ and } j = D \text{ for } E \\ \frac{2\tau\pi^D - c_E}{1+\delta_M} & \text{if } j = S \text{ for } E \text{ and } j = D \text{ for } M \end{cases}$$

  - ▶ under $\delta_i < \overline{\delta}_i \ \forall i$, M takes D and leaves if

  $$0 < \begin{cases} \frac{2\tau\pi^D - (1-\tau)\pi^D - \mathbb{E}_M[p^S]\Delta\pi\alpha_M - c_E^S}{1+\delta_M} + c_M^S & \text{if MLPS is used} \\ \frac{2\tau\pi^D - (1-\tau)\pi^D - \mathbb{E}_M[p^S]\Delta\pi\alpha_M}{1+\delta_M} + c_M^S & \text{if only MPS is used} \\ 2\tau\pi^D - (1-\tau)\pi^D - c_E^S & \text{if only EPS is used} \\ 2\tau\pi^D - (1-\tau)\pi^D & \text{if PS is not used at any layer} \end{cases}$$

Framework / cont'd

▶ PS at layer M too may influence incentives to innovate of agent E
  ▶ ω_{Mt1} is higher when E chooses D
  ▶ assume that there is no PS at layer M and M has power over c_E^S
  ▶ if EPS is in place, c_E^S decreases the likelihood that agent E chooses S:
    so M has an incentive to increase c_E^S, but
    ▶ if M's action is successful and $\delta_E > \bar{\delta}_E$, E takes $D \to \omega_{Mt1}\uparrow$
    ▶ if M's action is unsuccessful and $\delta_E < \bar{\delta}_E$, E takes $S \to \omega_{Mt1}\downarrow$
      (if M expects it will be so, he may be tempted to reduce c_E^S)

▶ Wrap-up: whether PS policies influence innovation at the firm level is
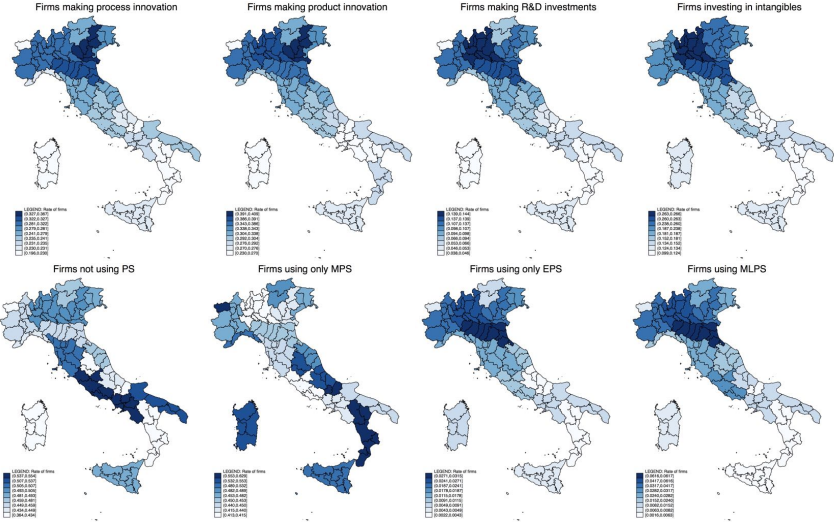 an empirical question

Descriptive stats, by PS policy

	ONLY EPS	ONLY MPS	EPS & MPS	WITHOUT PS
INNOVATION ACTIVITY				
Invested in R&D (0/1)	0.412 (0.492)	0.057 (0.232)	0.436 (0.496)	0.109 (0.312)
Invested in automation (0/1)	0.607 (0.488)	0.146 (0.353)	0.579 (0.493)	0.221 (0.415)
Introduced process innovation (0/1)	0.549 (0.497)	0.227 (0.419)	0.609 (0.488)	0.295 (0.456)
Introduced product innovation (0/1)	0.584 (0.493)	0.288 (0.453)	0.647 (0.477)	0.346 (0.475)
WORKFORCE'S CHARACTERISTICS				
Share of employees with tertiary education	0.118 (0.155)	0.089 (0.203)	0.176 (0.181)	0.115 (0.208)
Share of employees 50+ years old	0.268 (0.154)	0.196 (0.259)	0.280 (0.151)	0.211 (0.219)
CEO'S CHARACTERISTICS				
The CEO has tertiary education (0/1)	0.546 (0.155)	0.220 (0.414)	0.645 (0.478)	0.294 (0.455)
The CEO is 50+ years old (0/1)	0.704 (0.456)	0.624 (0.484)	0.729 (0.444)	0.628 (0.483)
The CEO is male (0/1)	0.935 (0.246)	0.838 (0.367)	0.949 (0.219)	0.854 (0.352)
OWNER TYPE				
A family or an individual (0/1)	0.497 (0.500)	0.927 (0.258)	0.397 (0.489)	0.831 (0.374)
A financial institution (0/1)	0.217 (0.413)	0.035 (0.185)	0.331 (0.470)	0.074 (0.262)
Another firm (0/1)	0.156 (0.363)	0.027 (0.162)	0.182 (0.386)	0.062 (0.241)
Other type of owner (0/1)	0.128 (0.334)	0.008 (0.092)	0.088 (0.283)	0.032 (0.176)
SPAN OF CONTROL				
# of employees / # of managers	60.13 (64.97)	14.09 (59.77)	67.39 (96.05)	40.92 (87.32)
INDUSTRIAL RELATIONS				
Unionization rate	0.376 (0.270)	0.116 (0.240)	0.357 (0.238)	0.150 (0.254)
Rate of voluntary separations	0.024 (0.060)	0.054 (0.361)	0.026 (0.145)	0.058 (0.473)
The firm uses individual-based PRP (0/1)	0.313 (0.464)	0.011 (0.106)	0.323 (0.468)	0.015 (0.124)
CORPORATE FORM				
The firm is a limited company (0/1)	0.974 (0.159)	0.415 (0.492)	0.962 (0.190)	0.801 (0.399)
OTHER CHARACTERISTICS				
# of employees	373 (5004.69)	28 (192.29)	570 (3726.14)	36 (178.900)
Total revenues (mln euro)	263.88 (4619.80)	8.46 (78.50)	137.11 (558.88)	12.37 (126.41)
The firm is an exporter (0/1)	0.522 (0.499)	0.142 (0.349)	0.587 (0.492)	0.251 (0.433)
The firm belongs to a group (0/1)	0.454 (0.498)	0.076 (0.266)	0.630 (0.482)	0.131 (0.338)
# of years since incorporation	35.75 (18.23)	25.43 (24.31)	37.24 (30.74)	26.87 (26.04)

Distribution of firms, by PS and innovation

Firms making process innovation Firms making product innovation Firms making R&D investments Firms investing in intangibles

Firms not using PS Firms using only MPS Firms using only EPS Firms using MLPS

back

Alternative extensions of layers

	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN.	[4] THE FIRM MAKES ANY INN.	[5] THE FIRM MAKES ANY INN.
MPS (non-executives + non-managerial supervisors)	0.018 (0.044)				
EPS (white/blue collars)	0.074** (0.036)				
MPS (non-executives)		-0.035 (0.053)	-0.042 (0.053)	-0.033 (0.012)	-0.037 (0.051)
EPS (white/blue collars + non-managerial supervisors)		0.087*** (0.028)	0.067** (0.029)	0.063** (0.029)	0.056** (0.028)
CEO's pay based on PS	0.010 (0.013)	0.010 (0.013)	0.009 (0.013)	0.011 (0.013)	0.013 (0.012)
CEO's pay based on shares/stock options	0.006 (0.075)	0.006 (0.075)	0.011 (0.074)	0.019 (0.074)	0.018 (0.073)
CEO's pay based on PS and shares/stock options	-0.008 (0.050)	-0.005 (0.050)	-0.004 (0.050)	-0.001 (0.050)	-0.002 (0.049)
Individual-based PRP	-0.037 (0.031)	-0.037 (0.031)	-0.047 (0.032)	-0.042 (0.031)	-0.048 (0.030)
Investments in R&D	NO	NO	0.164*** (0.017)	NO	NO
Investments in automation	NO	NO	NO	0.105*** (0.012)	NO
Innovation in 2007-09	NO	NO	NO	NO	0.216*** (0.009)
Other firm-level controls	YES	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15	2010/15
# of obs.	6928	6928	6896	6896	6928
Estimation	LOGIT	LOGIT	LOGIT	LOGIT	LOGIT

back

Process and product innovation

	[1] THE FIRM MAKES PROCESS INN.	[2] THE FIRM MAKES PRODUCT INN.	[3] THE FIRM MAKES PROCESS INN.	[4] THE FIRM MAKES PROCESS INN.	[5] THE FIRM MAKES PRODUCT INN.	[6] THE FIRM MAKES PRODUCT INN.
MPS	0.014	0.007	0.006	0.001	-0.010	-0.005
	(0.011)	(0.011)	(0.021)	(0.019)	(0.022)	(0.020)
EPS	0.056**	0.041*	0.070*	0.155***	0.143***	0.100**
	(0.022)	(0.024)	(0.038)	(0.042)	(0.041)	(0.047)
Individual-based PRP	-0.048*	-0.014	0.028	-0.060	-0.003	0.016
	(0.026)	(0.028)	(0.049)	(0.057)	(0.054)	(0.057)
Investments in R&D	0.059***	0.097***	NO	NO	NO	NO
	(0.015)	(0.016)				
Investments in automation	0.032***	0.040***	NO	NO	NO	NO
	(0.012)	(0.012)				
Innovation in 2007-09	0.168***	0.211***	NO	NO	NO	NO
	(0.009)	(0.009)				
Other firm-level controls	YES	YES	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15	2010/15	2010/15
Innovation over 2004-2006	ANY	ANY	=0	=1	=0	=1
# of obs.	7005	7004	2461	1720	2461	1759
Estimation	LOGIT	LOGIT	LOGIT	LOGIT	LOGIT	LOGIT

back

Propensity score matching

	ATT: MPS EFFECTS		
	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN.
MPS	0.023 (0.026)	0.015 (0.026)	0.016 (0.026)
EES-INAPP waves	2010/15	2010/15	2010/15
# of obs. (treated + control)	2233	2253	2253
t	0.877	0.567	0.622
Common support	YES	YES	YES
Balancing property	SATISFIED	SATISFIED	SATISFIED
Matching ATT estimators	RADIUS	KERNEL	STRATIFICATION

	ATT: EPS EFFECTS		
	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN.
EPS	0.117** (0.052)	0.111** (0.057)	0.114** (0.075)
EES-INAPP waves	2010/15	2010/15	2010/15
# of obs. (treated + control)	555	587	587
t	2.228	1.925	2.504
Common support	YES	YES	YES
Balancing property	SATISFIED	SATISFIED	SATISFIED
Matching ATT estimators	RADIUS	KERNEL	STRATIFICATION

▶ Probs of adopting MPS/EPS conditional on $\mathbf{X}_{f,w-1}$ + innovation in 2007-2009, firm belonging to a trade association, presence of ER, I/II level agreements, region and sector dummies, EPS/MPS

back

Standard interactions

	[1] THE FIRM MAKES ANY INN.	[2] THE FIRM MAKES ANY INN.	[3] THE FIRM MAKES ANY INN.	[4] THE FIRM MAKES ANY INN.
MPS	0.007	0.007	0.010	0.012
	(0.012)	(0.012)	(0.012)	(0.012)
EPS	0.077**	0.057**	0.052*	0.052*
	(0.032)	(0.033)	(0.032)	(0.026)
MPS × EPS	0.013	0.011	0.015	-0.003
	(0.047)	(0.047)	(0.047)	(0.045)
Individual-based PRP	-0.035	-0.045	-0.041	-0.046
	(0.031)	(0.031)	(0.032)	(0.030)
Investments in R&D	NO	0.165***	NO	NO
		(0.017)		
Investments in automation	NO	NO	0.108***	NO
			(0.012)	
Innovation in 2007-09	NO	NO	NO	0.215***
				(0.009)
Other firm-level controls	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15
# of obs.	7051	7018	7018	7051
Estimation	LOGIT	LOGIT	LOGIT	LOGIT

back

Multi-layering on process and product innovation

	[1] THE FIRM MAKES PROCESS INN.	[2] THE FIRM MAKES PRODUCT INN.	[3] THE FIRM MAKES PROCESS INN. MPS=0	[4] THE FIRM MAKES PROCESS INN. MPS=1	[5] THE FIRM MAKES PRODUCT INN. MPS=0	[6] THE FIRM MAKES PRODUCT INN. MPS=1
Only MPS	0.012	0.003				
	(0.012)	(0.011)				
(β_2) Only EPS	0.077***	0.052*				
	(0.025)	(0.028)				
(β_3) MLPS	0.076**	0.088***				
	(0.029)	(0.032)				
EPS (instrumented)			4.395***	2.761*	3.152***	2.801*
			(0.248)	(1.698)	(0.880)	(1.519)
H_0: $\beta_3 - \beta_2 = 0$ [p-value]	[0.972]	[0.356]				
Individual-based PRP	-0.049*	-0.011	-1.534***	-0.905	-0.036***	-0.917*
	(0.025)	(0.027)	(0.112)	(0.579)	(0.322)	(0.526)
Innovation in 2007-09	0.177***	0.223***	0.209***	0.576***	0.558***	0.566**
	(0.009)	(0.008)	(0.101)	(0.164)	(0.156)	(0.156)
Other firm-level controls	YES	YES	YES	YES	YES	YES
Sector and region dummies	YES	YES	YES	YES	YES	YES
EES-INAPP waves	2010/15	2010/15	2010/15	2010/15	2010/15	2010/15
# of obs.	7369	7368	4244	3171	4242	3172
Estimation	LOGIT	LOGIT	IV-LOGIT	IV-LOGIT	IV-LOGIT	IV-LOGIT
			FIRST-STAGE		FIRST-STAGE	
II-level agree.s in 2006 (sector avg.)			0.241***	0.233***	0.256***	0.249***
			(0.066)	(0.067)	(0.066)	(0.067)

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The 1/N problem

▶ PS may suffer from free riding both on working and peer-monitoring effort (Drago & Garvey, JLE 1998)
 ▶ the higher the # of workers (N), the greater is the dilution of incentives
  ▶ evidence is puzzling (PS adoption by size)

▶ Measure the conditional margins of EPS as

$$\frac{\partial \Pr(\text{Innovation}_{f,w} = 1)}{\partial \text{EPS}_{f,w-1}} = \frac{e^{\beta x}}{(1 + e^{\beta x})^2} \frac{\partial (\beta x)}{\partial \text{EPS}_{f,w-1}}$$

at $\left[\text{MPS}_{f,w-1} = (0\ 1) \,|\, \# \text{ of non-managerial employees}_{f,w-1}, \text{E}(\mathbf{X}_{f,w-1}) \right]$

The 1/N problem: results
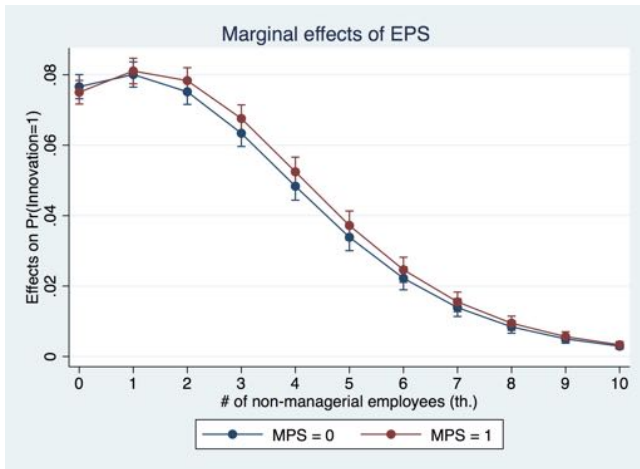
▶ Placebo placebo

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PS policy of firms, by size-class

(!!)
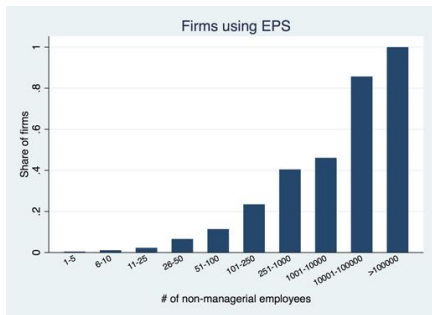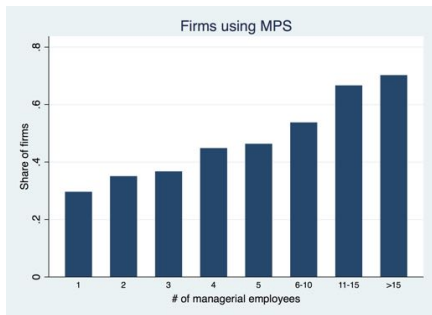
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The 1/N problem: placebo
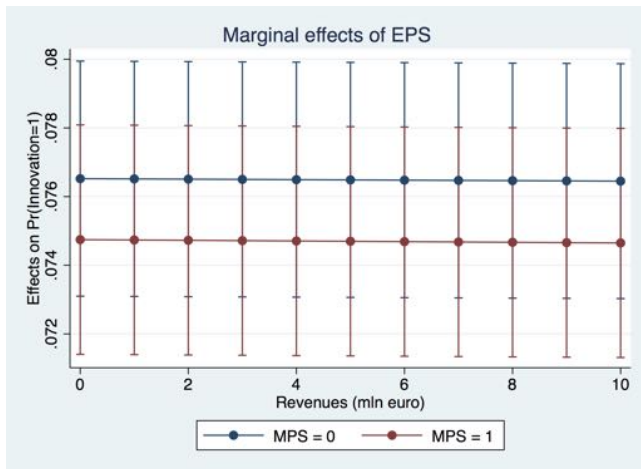
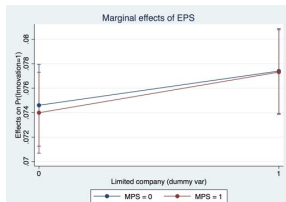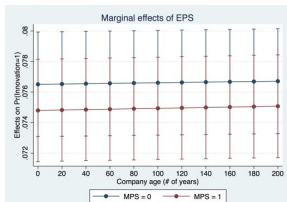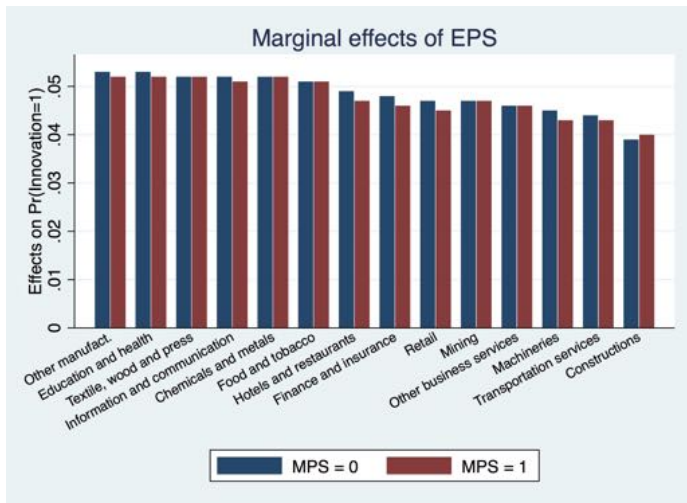
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Conditional margins
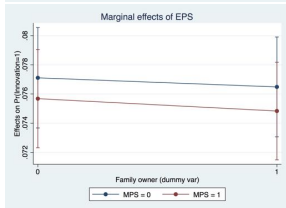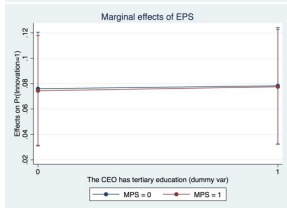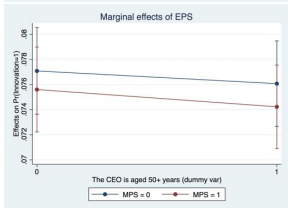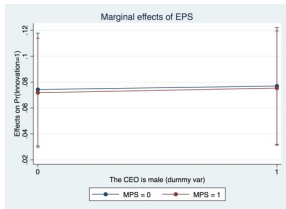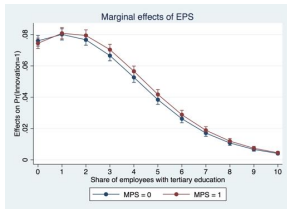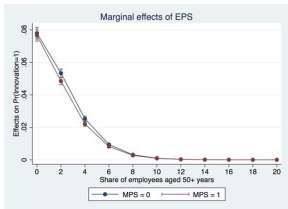
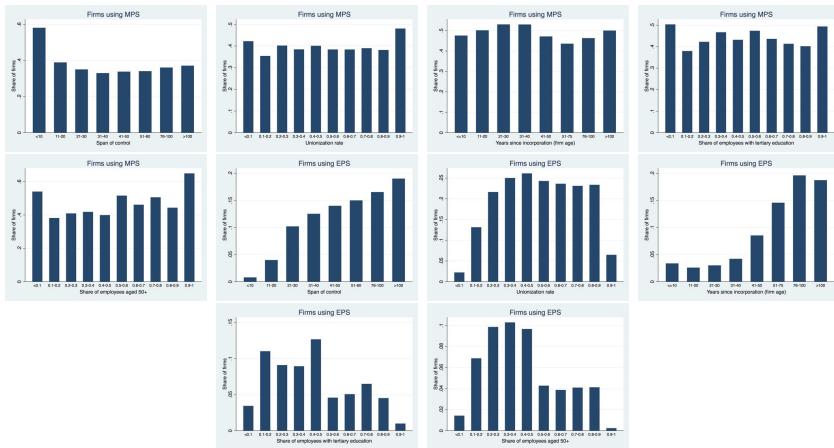# Conditional margins / cont'd
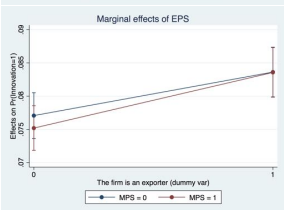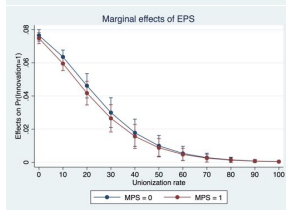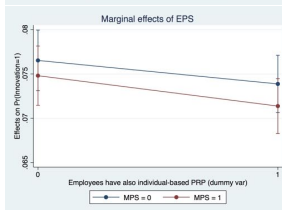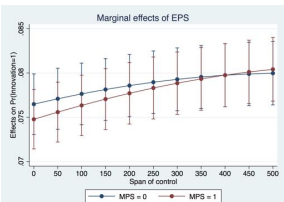
▶ Sectoral margins sectoral

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Sectoral margins

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PS policies, by firm characteristics