

Innovation and organizational practices. An analysis of Uruguayan service firms

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Motivation

- Study of innovative behavior has grown in both academic and public policy approaches.
- Inconclusive results have been found about innovation determinants. Many of the effects attributable to **idiosyncratic factors**.
 - ▶ This is expected according to Schumpeterian and Penrosian perspectives.
 - ▶ Usually attributed to managerial decisions or tacit knowledge.
- Relatively little literature inquiring on this topic.
- This paper contributes to the literature, investigating on the relation between organizational practices and innovative behavior, comparing between manufacturing and services.

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In a nutshell

- Two type of organizational practices: knowledge sharing (KN) and pay-for-performance (PFP).
- These type of organizational practices are an appropriate indicator of idiosyncratic features of the firms, attributable to discretionary decisions that differ between them and determine innovative behavior.
- Using different panel tobit estimations we investigate for the effect of these practices on innovative effort (innovative expenditures).
- **Results:** positive effects for some of the practices, differing between and within sectors. More practices lead to a greater expenditure.

Theoretical Framework

- Organization of the firm as an indicator of the resource mobilization inside the firm, according to its basic capabilities and its innovative strategy (Cerulli and Poti, 2015).
 - ▶ Aiming to overcome residual explanations of management and organizational factors in firms' performance.
- Organizational practices promoting workers' participation and reducing hierarchical levels boost innovation and creativity.
- Participation of floor employees in work teams has usually been considered as an indicator of worker autonomy (Bradley et al. 2016; Belloc, 2012).
- Empirical evidence on positive effects of PFP on firm innovation propensity (Laursen, 2002).

Hypothesis

Hypothesis 1

There is a significant and positive relationship between KS and PFP, and innovation propensity in the Uruguayan firms.

Hypothesis 2

There are heterogeneous effects of different Organizational Practices in Innovative Propensity.

Hypothesis 3

There are different effects of each organizational practice in innovation propensity according to the sector where firms operate.

Hypothesis 4

There are cumulative effects of KS and PFP practices in innovation propensity, for traditional and low-tech sectors.

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Two statistical sources:

I Uruguayan Innovation Survey (UIS)

- ▶ Triennial survey following the Oslo Manual (OCDE, 2005).
- ▶ First edition 1998-2000.
- ▶ Due to differences in the question formulation we employ only the last three waves (2007-2009, 2010-2012, 2013-2015).

II Survey of Economic Activity (SEA):

- ▶ Annual survey collecting firms' performance information.
- ▶ Sectorial variables of Gross Fixed Capital Formation, Gross Value of Production and Competitiveness.

Variables

- The dependent variable is the **expenditure on innovative activities** (EIA) relative to the total income obtained from sales.
 - ▶ As not every firms register innovative expenditure, there are missing values. We impute 0 values to such firms to estimate a tobit model.
- The variables of interest are four:
 - i Implementation of auspicious workspaces.
 - ii Reduction of hierarchical levels.
 - iii Improvement of communication systems.
 - iv Use of salary incentives.
- All variables, except from those of the SEA, are at firm level.

Variables

- We have an unbalanced panel with 6211 observations of 3209 firms. From these, 1330 (41.4%) surveyed all waves, 342 (10.7%) are present in two waves and the remaining 1537 (47.9%) are in only one wave.
- The minimum innovative expenditure is 0% and the maximum is nearly 5%. On the other hand, the mean is 0.019% and about 60% have null expenditure. No differences between services and manufacturing.
- Manufacturing is 49.8% and Services 50.2% of the sample.
- High-technology firms are 34.8%, low-technology firms are 10%, KIBS firms are 25.5% and traditional firms 29.7%.

Descriptive statistics: Dependent and interest variables

Variable	Unbalanced Panel		Balanced Panel	
	Mean	Std. Dev	Mean	Std. Dev
EIA	0.019	0.128	0.019	0.108
Workspaces	0.329	0.470	0.356	0.479
Hierarchical red.	0.095	0.293	0.091	0.288
Communication	0.423	0.494	0.432	0.495
Incentives	0.230	0.421	0.219	0.413

Descriptive statistics: Control variables

Variable	Unbalanced Panel		Balanced Panel	
	Mean	Std. Dev	Mean	Std. Dev
Size	3.651	1.421	3.911	1.382
Professionals	0.607	1.230	0.731	1.350
Age	2.810	0.928	3.043	0.802
Gross value	18.243	1.323	18.360	1.273
GFC	26.747	0.982	26.636	0.996
Lerner Index	0.792	0.229	0.769	0.232
Foreign capital	0.128	0.334	0.129	0.336
High-tech manufacturing	0.224	0.417	0.213	0.409
KIBS	0.462	0.499	0.432	0.495
Export	0.230	0.421	0.264	0.441
Services	0.551	0.497	0.502	0.500
Cooperation	0.130	0.337	0.134	0.341
Network	0.147	0.354	0.159	0.365
Groups	0.161	0.365	0.174	0.379

Econometric strategy

- As more than 60% firms have null expenditure, there is a censure problem.
- It can be thought as a latent variable problem, where y_i^* is the latent variable, observed only y_i^* when positive, whereas we observe 0 when it is negative:

$$y_i = \begin{cases} 0, & \text{if } y_i^* \leq 0 \\ y_i^*, & \text{if } y_i^* > 0 \end{cases}$$

- The equation to be estimated is:

$$y_{it} = X_{it}\beta + W_{it}\gamma + u_{it} \quad (1)$$

Econometric Strategy

- The last equation is estimated for the whole sample, separating by sector and then by low and high technology in manufacturing and traditional and KIBS firms in services.
- We run each estimation for both balanced and unbalanced panels.
- For investigating about the use of multiple practices we replace X_{it} by the interactions of all the practices. Then we employ the linear sum of such practices, for capturing the effect of employ one extra practice.
- Finally, given potential bidirectionality that could cause an endogeneity problem we employ instrumental variables estimation, instrumenting each of the practices by its value on the previous period.
- All estimations are done through a tobit model, estimating by ML.

Results: between sectors

Variables	Unbalanced panel		
	Global	Manufacturing	Services
Workspaces	0.060*** (0.001)	0.031*** (0.011)	0.074*** (0.015)
Level reduction	0.008 (0.012)	0.003 (0.014)	0.019 (0.019)
Communication	0.068*** (0.009)	0.046*** (0.010)	0.084*** (0.014)
Incentives	0.034*** (0.009)	0.018 (0.011)	0.035** (0.014)
Balanced panel			
Workspaces	0.047*** (0.009)	0.064** (0.017)	0.026*** (0.008)
Level reduction	0.021* (0.012)	0.039* (0.022)	0.004 (0.011)
Communication	0.041*** (0.009)	0.055*** (0.016)	0.027*** (0.008)
Incentives	0.012 (0.009)	0.020 (0.017)	0.002 (0.008)

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Incentives	0.012 (0.009)	0.020 (0.017)	0.002 (0.008)

Results: between sectors

- Two practices with clear effects on innovative effort, for every sample: workspaces and communication.
- Different effects by sectors.
- Salary incentives only significant for services.
- On the balanced panel the effects in services are reduced.
 - ▶ Possible explanation: the positive marginal effects of organizational practices are smaller for better-formed firms, which may have some other factors that improve their innovation behavior. However, not valid for manufacturing.
- On the balanced panel, level reduction also significant but with fewer effects and only significant at a 10% level.

Results: within sector

Unbalanced panel				
	High-tech	Low-tech	KIBS	Traditional
Workspaces	0.009 (0.007)	0.028** (0.011)	0.046*** (0.015)	0.090*** (0.024)
Level reduction	-0.002 (0.009)	0.004 (0.015)	0.02 (0.19)	0.006 (0.033)
Communication	0.001 (0.007)	0.052*** (0.011)	0.068*** (0.016)	0.089*** (0.22)
Incentives	0.003 (0.007)	0.012 (0.011)	0.011 (0.014)	0.052** (0.024)
Balanced panel				
Workspaces	0.017** (0.008)	0.030*** (0.011)	0.053** (0.022)	0.058** (0.023)
Level reduction	0.007 (0.011)	0.005 (0.014)	0.042 (0.027)	0.021 (0.033)
Communication	0.005 (0.008)	0.035*** (0.010)	0.042** (0.022)	0.065*** (0.022)
Incentives	0.005 (0.008)	0.001 (0.005)	0.021 (0.020)	0.024 (0.024)

Results: within sector

Unbalanced panel				
	High-tech	Low-tech	KIBS	Traditional
Workspaces	0.009 (0.007)	0.028** (0.011)	0.046*** (0.015)	0.090*** (0.024)
Level reduction	-0.002 (0.009)	0.004 (0.015)	0.02 (0.19)	0.006 (0.033)
Communication	0.001 (0.007)	0.052*** (0.011)	0.068*** (0.016)	0.089*** (0.22)
Incentives	0.003 (0.007)	0.012 (0.011)	0.011 (0.014)	0.052** (0.024)
Balanced panel				
Workspaces	0.017** (0.008)	0.030*** (0.011)	0.053** (0.022)	0.058** (0.023)
Level reduction	0.007 (0.011)	0.005 (0.014)	0.042 (0.027)	0.021 (0.033)
Communication	0.005 (0.008)	0.035*** (0.010)	0.042** (0.022)	0.065*** (0.022)
Incentives	0.005 (0.008)	0.001 (0.005)	0.021 (0.020)	0.024 (0.024)

Results: within sectors

- No significant effect on high-tech firms. However, about only 600 observations.
- For the other subsamples two practices significant and positive effects: communication and workspaces.
- Relatively higher effects for low-tech and traditional firms, relative to high-tech and KIBS, respectively.
- Estimate run with balanced panel-data-set confirm previous estimations: workspaces and communication are significant and the effects are higher for low-tech and traditional firms.

Results: IV

	Unbalanced panel		
Variables	Global	Manufacturing	Services
Workspaces	-0.024 (0.030)	-0.003 (0.012)	-0.034 (0.059)
Level reduction	0.040 (0.044)	0.023 (0.018)	-0.015 (0.088)
Communication	0.061 (0.046)	0.020 (0.018)	0.014 (0.091)
Incentives	0.019 (0.023)	0.005 (0.009)	0.009 (0.045)
	Balanced panel		
Workspaces	-0.024 (0.022)	-0.008 (0.013)	-0.035 (0.044)
Level reduction	0.013 (0.031)	0.021 (0.018)	-0.019 (0.062)
Communication	0.076** (0.033)	0.028 (0.019)	0.130** (0.066)
Incentives	0.012 (0.017)	0.001 (0.010)	0.012 (0.034)

Results: IV

Variables	Unbalanced panel		
	Global	Manufacturing	Services
Workspaces	-0.024 (0.030)	-0.003 (0.012)	-0.034 (0.059)
Level reduction	0.040 (0.044)	0.023 (0.018)	-0.015 (0.088)
Communication	0.061 (0.046)	0.020 (0.018)	0.014 (0.091)
Incentives	0.019 (0.023)	0.005 (0.009)	0.009 (0.045)
Balanced panel			
Workspaces	-0.024 (0.022)	-0.008 (0.013)	-0.035 (0.044)
Level reduction	0.013 (0.031)	0.021 (0.018)	-0.019 (0.062)
Communication	0.076** (0.033)	0.028 (0.019)	0.130** (0.066)
Incentives	0.012 (0.017)	0.001 (0.010)	0.012 (0.034)

Results: IV

- When instrument variables estimations are run, the significant results previously found disappear.
- Communication is significant only for services and with an effect higher to those previously observed.

Concluding remarks

- Regarding to our hypothesis we found:
 - i Significant effects for KS practices. PFP significant only for services.
 - ii Effects differ by practice. In most cases communication with higher effects.
 - iii Different effects by sector. Higher effects for services.
 - iv Higher effects for low technological manufacturing firms and traditional services firms.
- More work is needed for treating the endogeneity. The approach used here drops about half of the sample.
- Improving the dependent variable is crucial.

Extras: practices interaction

WLCI	Unbalanced panel			Balanced panel		
	Global	Manuf	Services	Global	Manuf	Services
0001	0.072*** (0.020)	0.035 (0.022)	0.093*** (0.033)	0.038* (0.020)	0.076** (0.039)	0.012 (0.017)
0010	0.100*** (0.014)	0.064*** (0.016)	0.127*** (0.021)	0.054*** (0.013)	0.080*** (0.023)	0.035*** (0.012)
0100	0.050 (0.033)	0.016 (0.031)	0.082 (0.063)	0.049 (0.030)	0.092 (0.068)	0.018 (0.023)
1000	0.109*** (0.017)	0.063*** (0.018)	0.137*** (0.030)	0.077*** (0.016)	0.114*** (0.032)	0.037*** (0.013)
1100	0.109** (0.046)	0.0464 (0.052)	0.162** (0.073)	0.059 (0.045)	0.090 (0.078)	0.028 (0.043)
0011	0.116*** (0.018)	0.078*** (0.023)	0.144*** (0.027)	0.073*** (0.019)	0.093*** (0.034)	0.044*** (0.017)
0101	0.143*** (0.055)	0.083 (0.073)	0.170** (0.078)	0.095* (0.054)	0.186** (0.088)	0.014 (0.058)
0110	0.086*** (0.031)	0.093*** (0.032)	0.067 (0.055)	0.055* (0.032)	0.029 (0.066)	0.052** (0.026)

Extras: practices interaction

WLCI	Unbalanced panel			Balanced panel		
	Global	Manuf	Services	Global	Manuf	Services
1001	0.097*** (0.029)	0.053* (0.028)	0.107** (0.053)	0.062** (0.027)	0.050 (0.061)	0.045** (0.021)
1010	0.144*** (0.013)	0.086*** (0.015)	0.186*** (0.019)	0.104*** (0.012)	0.143*** (0.021)	0.065*** (0.011)
0111	0.153*** (0.044)	0.109** (0.055)	0.191*** (0.064)	0.124*** (0.046)	0.181** (0.076)	0.083* (0.046)
1011	0.164*** (0.014)	0.096*** (0.018)	0.196*** (0.021)	0.091*** (0.013)	0.133*** (0.024)	0.049*** (0.012)
1101	0.168*** (0.064)	0.109* (0.065)	0.212* (0.112)	0.131** (0.056)	0.189 (0.121)	0.089** (0.044)
1110	0.114*** (0.024)	0.064** (0.026)	0.170*** (0.037)	0.093*** (0.021)	0.140*** (0.040)	0.044** (0.019)
1111	0.176*** (0.023)	0.093*** (0.031)	0.226*** (0.033)	0.137*** (0.024)	0.205*** (0.043)	0.061*** (0.023)

Extras: OPI

Variables	Unbalanced panel		
	Global	Manufacturing	Services
OPI high	0.174*** (0.023)	0.086*** (0.031)	0.226*** (0.033)
OPI medium-high	0.151*** (0.013)	0.085*** (0.015)	0.190*** (0.019)
OPI medium	0.128*** (0.011)	0.079*** (0.013)	0.164*** (0.017)
OPI medium-low	0.093*** (0.011)	0.053*** (0.012)	0.120*** (0.017)
Balanced panel			
OPI high	0.137*** (0.024)	0.058*** (0.022)	0.205*** (0.042)
OPI medium-high	0.092*** (0.012)	0.046*** (0.011)	0.137*** (0.023)
OPI medium	0.090*** (0.010)	0.056*** (0.009)	0.123*** (0.019)
OPI medium-low	0.057*** (0.010)	0.030*** (0.009)	0.088*** (0.020)