Diffusion of Innovation

A Review of Readings

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Outline

Bridging the micro and macro aspects of Innovation

- General Purpose Technologies and Innovation
- Diffusion of Innovation
- Trade and Innovation

Diffusion of Innovation

- Stoneman and Battisti (2010) - Technological diffusion from demand and supply side, at different levels of analysis
- Atkin et al. (2015) - Empirical study on organizational impediments to adoption of technology
- Bollinger and Gillingham (2012) - Empirical study of peer effects in technology diffusion

The Diffusion of New Technology

Agenda

- Scope of Definition of Technology Diffusion
- Demand and Supply Side
- Diffusion at different levels of aggregation - worldwide, industry, household

The Diffusion of New Technology

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Table 1
Automobile output selected countries: World production shares 1960, 1989, and annual average % change in production, 1960–1989

	Share 1960	Share 1989	% Growth 1960–1989
World	100.0	100.0	6.0
United States	51.4	19.2	0.1
Canada	2.5	2.8	7.1
West Germany	14.0	12.9	5.2
United Kingdom	10.4	3.7	− 0.1
Spain	0.3	4.6	128.0
Japan	1.3	25.5	185.7
Brazil	0.3	2.1	62.9
USSR	1.1	3.7	28.8

Source: Dicken (1992).

Figure: Source: Stoneman and Battisti (2010)

The Diffusion of New Technology

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Table 2
Enterprises grading innovation-inhibiting factors as highly important (% of respondents), EU, 1998–2000

Economic factors	Excessive perceived economic risk	15
	Direct innovation costs too high	21
	Availability of finance	15
Internal factors	Organizational rigidities	6
	Lack of qualified personnel	13
	Lack of information on technology	5
	Lack of information on markets	5
Other factors	Impact of regulation and standards	9
	Lack of customer responsiveness	7

Source: Eurostata, New Cronos (theme9/innovation/inn-cis3).

Figure: Source: Stoneman and Battisti (2010)

Organizational Barriers to Technology Adoption

Summary

- Scope of Definition of Technology Diffusion
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Organizational Barriers to Technology Adoption

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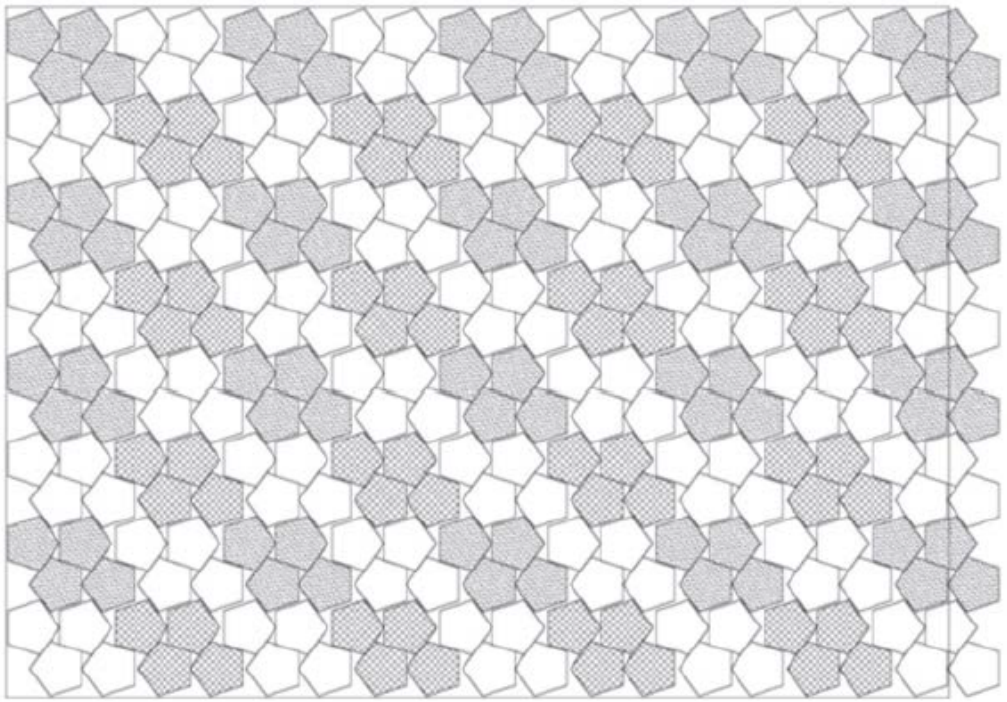

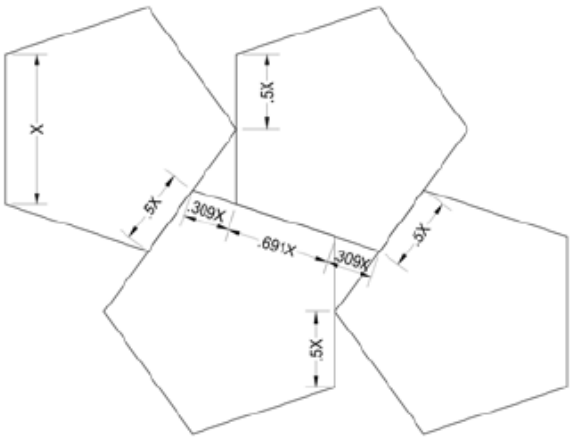

Figure: Source: Atkin et al. (2015)

Organizational Barriers to Technology Adoption

Summary

Table 1: Pentagons per Sheet

	traditional die		offset die	
	owner report (1)	direct obs. (2)	owner report (3)	direct obs. (4)
size 43.5	257.3	257.7	273.5	277.5
	(10.6)	(6.7)	(4.4)	(5.3)
size 43.75	256.3	254.4	269.0	272.0
	(6.7)	(9.4)	(1.4)	(0.0)
size 44	254.3	248.4	280.0	272.5
	(9.1)	(18.7)		(0.7)
size 44.25	246.1	262.0	272.0	
	(8.3)			
rescaled (to size 44)	254.2	248.3	280.0	275.4
	(8.9)	(11.0)	(3.0)	(4.8)
N (all sizes)	320	39	8	10

Notes: Table reports average (non-defective) pentagons per sheet by die size. Column 1 indicates self-reported numbers from the owner, several rounds per firm in some cases. Column 2 indicates pentagons per sheet directly observed by the survey team for tech-drop firms (during the initial cutting demonstration) and for cash-drop firms (at the time of the cash drop). Columns 3-4 report numbers for the offset die and were only collected from tech-drop firms. In the fifth row, pentagons per sheet are rescaled using means for each size in each column. The final row reports the pooled number of observations for all die sizes. Standard deviations in parentheses.

Figure: Source: Atkin et al. (2015)

Organizational Barriers to Technology Adoption

Summary

Table 4: Treatment Assignment, Tech-Drop Experiment

	# Firms			
	Tech Drop	Cash Drop	No Drop	Total
A. Initial responders				
smallest	5	3	12	20
medium-small	6	3	13	22
medium-large	6	3	13	22
largest	6	3	12	21
total	23	12	50	85
B. Initial non-responders				
active, late response	12	5	14	31
active, refused all surveys	0	1	15	16
inactive (revealed not to be a producer)	7	3	12	22

Notes: Table reports numbers of firms by treatment assignment among initial responders (Panel A) and initial non-responders (Panel B). Active firms are those who had produced soccer balls in the previous 12 months and cut their own laminated rexine. Last row reports numbers of firms included in initial randomization that were believed to be active (based on an initial listing exercise) but were later revealed not to be active by our definition, because they (a) had shifted entirely to other products, (b) had gone out of business, or (c) were not cutting their own laminated rexine.

Organizational Barriers to Technology Adoption

Summary

Table 9: Incentive-Payment Experiment (Conservative Adoption Measure)

	Dep. var.: adoption (>1,000 balls, cons. measure)			
	First Stage (1)	OLS (2)	Reduced Form (ITT) (3)	IV (TOT) (4)
A. Short-Run (as of Round 6)				
received treatment		0.45***		0.46***
		(0.16)		(0.16)
assigned to group A	0.68***		0.31**	
	(0.12)		(0.12)	
stratum dummies	Y	Y	Y	Y
mean of group B (control group)		0.12	0.12	0.12
R-squared	0.57	0.56	0.46	0.56
N	31	31	31	31
B. Medium-Run (as of Round 7)				
received treatment		0.39**		0.35*
		(0.17)		(0.19)
assigned to group A	0.72***		0.26*	
	(0.12)		(0.14)	
stratum dummies	Y	Y	Y	Y
mean of group B (control group)		0.20	0.20	0.20
R-squared	0.60	0.46	0.38	0.45

Organizational Barriers to Technology Adoption

Summary

Table 10: Incentive-Payment Experiment Results (Die Purchase as Outcome)

		Dep. var.: purchased offset die after Sept. 1, 2013		
	First Stage (1)	OLS (2)	Reduced Form (ITT) (3)	IV (TOT) (4)
A. Short-Run (as of Round 6)				
received treatment		0.42**		0.40**
		(0.15)		(0.16)
assigned to group A	0.68***		0.27**	
	(0.12)		(0.12)	
stratum dummies	Y	Y	Y	Y
mean of group B (control)		0.00	0.00	0.00
R-squared	0.57	0.40	0.24	0.40
N	31	31	31	31
B. Medium-Run (as of Round 7)				
received treatment		0.41**		0.38**
		(0.15)		(0.16)
assigned to group A	0.72***		0.28**	
	(0.12)		(0.12)	
stratum dummies	Y	Y	Y	Y
mean of group B (control)		0.00	0.00	0.00

Organizational Barriers to Technology Adoption

Summary

Table 8: Incentive-Payment Experiment (Liberal Adoption Measure)

	Dep. var.: adoption (>1,000 balls, liberal measure)			
	First Stage (1)	OLS (2)	Reduced Form (ITT) (3)	IV (TOT) (4)
A. Short-Run (as of Round 6)				
received treatment		0.48***		0.48***
		(0.15)		(0.15)
assigned to group A	0.68***		0.32**	
	(0.12)		(0.12)	
stratum dummies	Y	Y	Y	Y
mean of group B (control group)		0.19	0.19	0.19
R-squared	0.57	0.69	0.60	0.69
N	31	31	31	31
B. Medium-Run (as of Round 7)				
received treatment		0.41**		0.37**
		(0.16)		(0.17)
assigned to group A	0.72***		0.27*	
	(0.12)		(0.14)	
stratum dummies	Y	Y	Y	Y
mean of group B (control group)		0.27	0.27	0.27
R-squared	0.60	0.61	0.52	0.61

Peer Effects in Technology Diffusion

Summary

- Proxy for property rights: Political Risk Services assessment of protection against government expropriation in a country, Polity IV's constraint on executive measure

Atkin, D., Chaudhry, A., Chaudry, S., Khandelwal, A. K., and Verhoogen, E. (2015). Organizational barriers to technology adoption: Evidence from soccer-ball producers in pakistan. Working Paper 21417, National Bureau of Economic Research.

Bollinger, B. and Gillingham, K. (2012). Peer effects in the diffusion of solar photovoltaic panels. *Marketing Science*, 31(6):900–912.

Stoneman, P. and Battisti, G. (2010). Chapter 17 - the diffusion of new technology. In Hall, B. H. and Rosenberg, N., editors, *Handbook of the Economics of Innovation, Volume 2*, volume 2 of *Handbook of the Economics of Innovation*, pages 733 – 760. North-Holland.