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**From innovation to exporting or vice versa? Causal
link between innovation activity and exporting in
Slovenia**

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From innovation to exporting or vice versa? Causal link between innovation activity and exporting in Slovenian microdata

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- Recent empirical research on firm exporting behavior has stressed several empirical regularities:
 - exporting firms are shown to be superior in comparison to non-exporters in terms of productivity, capital intensity, wages, and size;
 - evidence in favor of self-selection of more productive firms into exporting is abundant;
 - while the evidence on learning-by-exporting is scarce.
- Very recently, the link between exporting and innovative activity has received increasing attention:
 - is innovation the missing link that can shed new light on the effects of exporting on firm characteristics?

Background (1)

- Empirical studies document large productivity premia of new exporters compared to non-exporters
 - implying that the decision to start exporting is determined by factors that affect productivity of firms before they start exporting.
- theoretical models on firm dynamics [Jovanovic (1982), Hopenhayn (1992), Melitz (2003)], however,
 - do not provide a convincing explanation of what generates this firm heterogeneity,
 - typically assume productivity is exogenous to the firm (as it is typically drawn from a distribution of productivities)
 - after making the draw, there is no way for a firm to change its life path - its survival or death.

Background (2)

- In contrast, endogenous growth theory associates firm productivity to decisions such as investment into R&D and innovation
- Romer (1990)
 - technological improvements stem from intentional investment of resources by profit-maximizing firms, and
 - a firm's innovative activity is central to its technological progression and productivity growth.
- Klepper (1996)
 - product innovation dominates the early stage of the product lifecycle,
 - process innovation gains relevance in the later stages, after production volumes have increased and efficiency of production becomes increasingly important.
- Constantini and Melitz (2007)
 - a model that shows that anticipation of trade liberalization may cause a firm to bring forward the decision to innovate in order to "dress up" for future participation in the export market.

Background (3)

- Over the last decade, many empirical studies have observed a positive impact of innovation on exporting [Wagner (1996), Wakelin (1997), Aw et al (2005), Becker and Egger (2007), Girma et al (2007)] .
- More recently, some studies found that process innovation, rather than product innovation positively affects productivity growth [Griffith et al (2006), etc.].
- Few studies, however, have controlled for firm innovation activity in an attempt to study the productivity-exporting link in its entirety as a causal relationship.
- Cassiman and Golovko (2007) and Cassiman and Martinez-Ros (2007)
 - find support for the product innovation - productivity - export link in data on Spanish firms,
- But the reverse causal direction (exporting - process innovation - productivity growth) has been investigated with less success.

- We believe that firm productivity and export decisions are closely related to innovation activity:
 - product innovation may play a more important role in the decision to start exporting,
 - while successful exporting may drive process innovation,
 - suggesting that the causality between innovation and exporting may run in both directions.
- Using detailed microdata from (1) innovation surveys, (2) industrial production surveys, (3) trade information, and (4) financial data for Slovenian firms in 1996-2002
 - we investigate the bi-directional causal relationship between firm innovation and export activity.

- Innovation data:
 - CIS1, CIS2, CIS3 (4 bi-annual panels, 1996-2002), covering also micro and small firms
- Industrial production survey (IPS)
 - Annual data at firm-product level (1995-2003), mostly medium and large firms (cut-off point at 20 empl.)
- Trade data
 - Annual data on firm-product trade flows (1995-2003) by destinations, all firms
- Financial data
 - Annual firm balance sheets (1994-2004), all firms

Table 1: Comparison of firm characteristics between exporters and non-exporters and innovators and non-innovators for 2002

	non-exporters		exporters	
	non-innovat.	innovators	non-innovat.	innovators
VA per emp.	19,627	19,707	21,257	21,293
Capital per emp.	48,156	48,781	68,843	65,998
R&D per emp.	0	2,692	0	1,603
Size (sales)	1,158,203	1,180,575	2,843,517	7,612,973
Size (emp.)	18	19, 5	28	112
Number	692	96	1181	394

Note: All variables in median values except number of firms. Value added per employee, capital per employee and sales in Euro (1994 prices).

Source: SORS and AJPES; authors' calculations

Table 2: Share of exporters depending on innovative activity by years

year	innovators share of exporters	non-innovators share of exporters
1996	87,4%	49,9%
1998	79,6%	50,5%
2000	87,0%	54,4%
2002	86,5%	72,4%

Source: SORS and AJPES; authors' calculations

Table 3: Share of innovators depending on export status

year	exporters share of innovators	non-exporters share of innovators
1996	28,1%	5,3%
1998	29,8%	9,9%
2000	26,5%	10,1%
2002	23,4%	11,1%

Source: SORS and AJPES; authors' calculations

- Are changes in either exporting (innovation) patterns related to innovating (exporting) status
 - exporting equation
 - does past innovation make a firm to start exporting

$$Prob(Exp_t = 1 | Exp_{t-2} = 0) = f(Inov_{t-2}) \quad (1)$$

- innovation equation
 - does past exporting status make a firm to start innovating

$$Prob(Inov_t = 1 | Inov_{t-2} = 0) = f(Exp_{t-2}) \quad (2)$$

Results with CIS data

Pooled ATT effects of lagged innovation (lagged export status) on the change in export status (change in innovation)

Product innovation						
	export equation			innovation equation		
	ATT	SE ^a	obs. ^b	ATT	SE ^a	obs. ^b
nn matching	0.015	0.014	265 (172)	-0.014	0.057	437 (33)
nn matching ^c	0.015	0.013	265 (172)	-0.014	0.046	437 (33)
kernel match.	-0.022	0.015	265 (722)	-0.020	0.038	437 (45)
r match.(r = 0.2)	-0.024*	0.013	265 (722)	0.013	0.030	331 (45)
Process innovation						
	export equation			innovation equation		
	ATT	SE ^a	obs. ^b	ATT	SE ^a	obs. ^b
nn matching	-0.001	0.016	245 (168)	0.016*	0.008	437 (33)
nn matching ^c	-0.001	0.017	245 (168)	0.016*	0.009	437 (33)
kernel match.	-0.030*	0.020	245 (168)	0.016*	0.010	437 (33)
r match.(r = 0.2)	-0.032**	0.013	245 (756)	0.046***	0.008	326 (33)

CIS results by size classes

Pooled ATT effects of lagged process innovation (lagged export status) on the change in export status (process innovation)

Small ($10 < Emp \leq 50$)	Pr[Exp_t]			Pr[$Inov_t$]		
	ATT	SE ^a	obs. ^b	ATT	SE ^a	obs. ^b
nearest neighbour matching	-0.024	0.037	95 (1026)	0.010	0.014	1050 (375)
nearest neighbour matching ^c	-0.024	0.038	95 (1026)	0.010	0.013	1050 (375)
kernel matching	-0.074***	0.020	95 (1389)	0.010	0.015	1050 (375)
radius matching ($r = 0.2$)	-0.077***	0.019	44 (382)	0.046***	0.008	4340 (766)
Medium ($50 < Emp \leq 200$)	ATT	SE ^a	obs. ^b	ATT	SE ^a	obs. ^b
nearest neighbour matching	0.027	0.024	270 (1177)	0.046*	0.024	1386 (152)
nearest neighbour matching ^c	0.027	0.021	270 (1177)	0.046	0.032	1386 (152)
kernel matching	0.023	0.022	270 (1351)	0.082*	0.049	1386 (154)
radius matching ($r = 0.2$)	0.014	0.025	105 (247)			
Large ($200 < Emp$)	ATT	SE ^a	obs. ^b	ATT	SE ^a	obs. ^b
nearest neighbour matching	0.005	0.011	275 (1532)	0.064***	0.023	1603 (164)
nearest neighbour matching ^c	0.005	0.011	275 (1532)	0.064***	0.024	1603 (164)
kernel matching	0.011	0.012	275 (1575)	0.057*	0.029	1603 (164)
radius matching ($r = 0.2$)	0.011	0.011	93 (88)			

Robustness check: Industrial production (IP) data

- Industrial production survey data enables to directly test the impact of exporting on number of products and on TFP growth
- Matching exporting and non-exporting firms (by industry) based on the following propensity score specification

$$Prob(Exp_t = 1 | Exp_{t-1} = 0) = f(\log TFP_{t-1}, \log k_{t-1}, \log l_{t-1}, \log NoP_t)$$

- we then use the matched pairs of exporters and non-exporters to evaluate whether lagged exporting status is associated with an increase in the number of products and an increase in the TFP growth
 - here, an increase in a number of products provides direct evidence of product innovation,
 - while an increase in the TFP provides indirect evidence of process innovations.

Table: ATT effects for number of products

<i>Nearest neighbor matching</i>					
Time span	Treated	Controls	ATT	Std.Err.	t-stat
t+1/t	165	118	0.083*	0.044	1.872
t+2/t	165	108	0.067	0.051	1.303
t+3/t	165	98	0.051	0.056	0.907

<i>Kernel matching</i>					
Time span	Treated	Controls	ATT	Std.Err.	t-stat
t+1/t	165	615	0.036	0.033	1.096
t+2/t	165	615	0.067*	0.035	1.900
t+3/t	165	615	0.018	0.051	0.354

Source: SORS, Slovenian Customs Office and own calculations.

Notes: Standard errors for kernel matching are based on bootstrapping.

Table: ATT effects for total factor productivity

<i>Nearest neighbor matching</i>					
Time span	Treated	Controls	ATT	Std.Err.	t-stat
t+1/t	165	131	0.140***	0.042	3.352
t+2/t	165	130	0.156***	0.070	2.220
t+3/t	165	132	0.239***	0.067	3.562

<i>Kernel matching</i>					
Time span	Treated	Controls	ATT	Std.Err.	t-stat
t+1/t	165	615	0.110***	0.035	3.145
t+2/t	165	615	0.097*	0.060	1.625
t+3/t	165	615	0.168***	0.046	3.670

Source: SORS, Slovenian Customs Office and own calculations.

Notes: Standard errors for kernel matching are based on bootstrapping.

Summary

Implications from exporting-innovation literature

- Product innovation is important to dress up for exporting
- Process innovation becomes important at a later stage when volumes of exports increase sufficiently
- Efficiency gains from exporting accrue only to medium and large new exporters
- . . . hence, policy measures should target
 - enhancing firm innovation capabilities, and
 - assisting micro and small exporters

Further evidence from firm-product export data for Slovenia

- In the first year of exporting:
 - 76 % of new exporters start serving only 1 market (46 % only 1 product)
 - 82 % of new exporters contained within the dimension 2 mkts x 4 prods
- After 9 years of exporting:
 - 32 % of surviving exporters still serving only 1 market (22 % only 1 product)
 - 44 % of surv. exporters still contained within the dimension 4 mkts x 4 prods
 - ... but 30 % of them making it to more than 5 mkts and more than 15 prods
- Clear pattern of expansion of exports over 9 years of exporting:
 - firms expand predominantly across the intensive margin (an increase by 4x)
 - median exporter increases #prods from 1 to 7
 - ... but increases #mkts only from 1 to 3

- huge heterogeneity among new exporters
 - 50 % of new exporters cease exporting after the first year
 - most of surviving exporters expand very slowly
 - some, however, are performing much better (medium and large new exporters)
- new exporters are facing several types of uncertainty
 - (in addition to uncertainty about firm-level ability and product - specific expertise)
 - uncertainty about demand in foreign markets
- exporting is costly
 - general entry cost to start exporting
 - market-specific entry cost
 - product-specific entry cost
 - mkt-specific cost seem to be higher than prod-specific entry cost

- General scheme for promotion of innovation
 - R&D subsidies
 - Tax credits for R&D expenditures?
 - Specific scheme for micro and small firms?
 - Sector-specific schemes?
 - Promotion of R&D cooperation between universities and businesses
- Promotion of entrepreneurship
 - Making of entrepreneurs from innovators
 - Promotion of venture capital financing
- Promotion of exporters
 - Training schemes for new exporters
 - General market-specific info made available generally
 - Reducing financial constraints
 - as bank loans do not work efficiently, do we need a state financial promotion small and medium exporters?
 - Promotion of industry- and product-specific clusters?
- Do we – by doing this - kill the selection issue?