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Export and innovative performance of Italian firms

preliminary results

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Motivation / 1

Research in international trade has changed dramatically over the past fifteen years as its focus has shifted from industries and countries to firms and products. This transformation was instigated by the emergence of a wide range of micro-datasets exhibiting sharp variation in firm outcomes and attributes, even within narrow industries. Models developed in reaction to this challenge both rationalize this heterogeneity and offer new insight into the ways in which economies respond to international trade... (Bernard et al, 2012)

Motivation / 2

Export is an issue of self-selection: exporters are more productive, not necessarily as a result of exporting, but because only the most productive firms are able to overcome the costs of entering export markets. The most successful model of such selection is the seminal Melitz (2003) model, which has dominated recent research in the field.

Many research show that exporting firms are larger, more skill intensive, more innovative and more productive…

In particular, the positive association between a firm's export status and its innovation can be considered as a strong empirical regularity in both international economics and the economics of innovation: a wide consensus has been reached on the fact that firms introducing innovations are ex-post more likely to export

Evidence for learning by exporting and on the importance of regional and sectoral spillovers is sparser and not conclusive…

Empirics on firm export performance

- Firm export performance has been measured in two ways
  - Extensive margin, that is the decision to export or not
  - Intensive margin, that is quota of export on sales

Empirical studies exploiting firm-level data have provided wide evidence supporting the role played by productivity and other sources of firm heterogeneity in explaining firm export activity (Bernard and Jensen, 2004)

- See, among others, Sterlacchini, 1999; Basile, 2001; Roper and Love, 2002; Lachenmaier and Woessmann, 2006; Becker and Egger, 2009; Cassiman et al., 2010; Cassiman and Golovko, 2011;
- For comprehensive surveys see Bernard et al (2007 and 2012), Greenaway and Kneller (2007), and Wagner (2007 and 2012), International Study Group on Exports and Productivity (ISGEP), 2008

Empirics on export performance and innovation

- Particularly, several recent papers have compared the export performance of innovative and non innovative firms, concluding that there is a significant positive correlation between innovation and exports (Basile, 2001; Castellani and Zanfei, 2007; Cassiman and Golovko, 2011).

- Although it can be argued that such correlation is the result of exporting firms been more prone to innovate (e.g. Aw et al, 2007; Bratti and Felice, 2012), the evidence available so far provides strong support in favour of a causal effect which goes mainly from innovation to exports, particularly in the case of product innovations (Nassimbeni, 2001; Roper and Love, 2002; Nguyen et al, 2008; Caldera, 2010).

Empirics on export performance, innovation and regions

- Most studies that have analysed the link between innovation and firm exports have somewhat neglected the role of space. However, aggregate regional data show sharp disparities across regions in exports, that suggest a potential link in a way or another to some regional characteristics.

- A number of more recent firm-level studies recognises the potential role played by agglomeration economies and other regional factors, and add them to the list of firm level characteristics when explaining firm export performance.
  - Andersson M, Weiss J F (2012): Sweden, 1997-2004
  - Koenig et al, (2010): France, 1998-2003
  - **Becchetti e Rossi, (2001): Italy, 1989-1991**
  - **Antonietti and Cainelli, (2011): Italy, 1998-2003**
  - Greenaway and Kneller, (2004): UK, 1998-2002
  - Farole and Winkler, (2013): multi-country
  - Rodríguez-Pose et al, (2013), Indonesia 1990-2005
  - Mukim (2012): India 1999-2004
  - Lopez-Baso and Motellon, (2013), Spain, 2004

Becchetti and Rossi, 2001

- Using a sample composed of over 3,800 manufacturing firms drawn from the Mediocredito Centrale database (more than 11 employees) for the period 1989–1991, find that spatial agglomeration, captured by localization within the boundary of an industrial district, increases average export intensity by 4% points.

- Tobit estimates show that geographical agglomeration significantly increases export intensity and export participation. The result is robust when controlled for firm size, sector and geographical areas and for the separate and positive effects of export subsidies and export “consortia” on export intensity.

Antonietti and Cainelli, 2011

- The dataset consists of a sample of Italian manufacturing firms drawn from the VIII and IX waves of the Survey by Unicredit-Capitalia, which covers the period 1998–2003. The master datasets gather information on 4.680 and 4.289 firms, but the final dataset is just **715** firms
- The model used in the paper is an 'augmented' version of the CDM model, developed to summarize the complex process "that goes from the firm decision to engage in research activities to the use of innovations in its production activities" (Crépon et al. 1998, p.116). It comprises five main equations
- Estimates show that agglomeration economies play a role in shaping the relationship between innovation, productivity and export performance. In particular, urbanization economies do positively affect both R&D and also the propensity to export and the relative export intensity

Aim and contribution

- We want to explain firm export performance in Italy in recent years (during the crisis)
- We aim at understanding how much such a performance (in terms of extensive and intensive margin) depends on
  - endogenous determinants (within the firm, with a specific emphasis on innovation, productivity and learning by exporting)
  - exogenous factors (which are external to the firms and relate either to the **sector** and most importantly to the **region**)

- We are still in the explorative stage. As a result, some potential issues of interest are currently not yet explored:
  - Before and during the crisis performance, for example…

Dataset / 1

We focus on the Italian case thanks to a new database (the MET survey) which has collected information at the firm level in four waves, every two years, since 2007/8

The MET survey is designed to focus on firms' structure and strategies (in particular R&D and innovation activities, the internationalisation process and network phenomena) as well as on their financial aspects.

- Population:
  - All italian firms in industrial sector (manufacturing, energy, mining) and production services (except finance and insurance, real estate, transportation for private consumption). It includes data on micro and family firms
- Stratification criteria:
  - Firm's dimension (4 classes – 1-9, 10-49, 50-249, 250<);
  - Regions (20 regions);
  - Sector (12 sectors in the manufacturing industry);
- Methodology:
  - CATI (Computer Assisted Telephone Interview);
  - CAWI (Computer Assisted Web Interview);

Dataset / 2

- Since we want to explain current performance with past determinants, firms have to appear at least in two consecutive years to be included in our analysis

- **MET** data have been merged with **CRIBIS** data to collect information on some important financial and economic indicators available in balance sheets.

	MET-firms	Two-period panel	Merge with CRIBIS
2007_8	**24,896**		
2009	**22,340**	**11,549**	**6,016**
2011	**25,090**	**13,901**	**5,797**
2013	**25,000**	**10,537**	**4,728**

- The final sample for our analysis thus consists of 16,541 firms

Some descriptive statistics/1

	ALL firms			Innovators		
	Exporter	Non-Exporter	Total	Exporter	Non-Exporter	Total
Nb. of firms	6510	10031	16541	2928	3334	6262
%	39%	61%	100%	47%	53%	100%
All at T-2						
Size	93.5	51.6	68.1	127.2	72.1	97.9
Productivity	38461	33620	35448	38094	33515	35583
Age	20.9	18.4	19.4	20.5	18.1	19.2
R&D Intensity	2.2	0.9	1.4	3.4	1.7	2.5
Group	26%	15%	19%	31%	20%	25%
Local Network	39%	42%	41%	47%	56%	52%

Some descriptive statistics/2

		exporters %	Export intensity		size	productivity	R&D intensity	innovators %
Piemonte	1277	50%	17.18		85.89	55602.98	1.77	35%
Valle d'Aosta	143	32%	10.45		33.73	148252.20	0.40	24%
Lombardia	1563	54%	20.76		79.52	58435.14	1.80	32%
Trentino Alto Adige	629	42%	16.34		110.81	69073.54	1.24	31%
Veneto	1910	45%	17.18		57.55	61614.88	1.61	36%
Friuli	352	59%	23.42		102.85	57790.61	1.10	34%
Liguria	414	46%	17.92		59.09	72628.69	1.36	33%
Emilia Romagna	1335	42%	14.38		85.10	54158.65	2.02	30%
Toscana	1563	43%	17.08		46.73	57450.68	1.47	33%
Umbria	506	33%	9.82		58.20	57357.44	1.35	35%
Marche	687	47%	16.50		44.82	49991.80	1.30	31%
Lazio	2014	29%	8.75		58.26	96832.19	1.09	30%
Abruzzo	247	45%	16.04		87.16	47494.61	1.23	27%
Molise	244	27%	6.60		19.90	55395.51	0.69	23%
Campania	1059	30%	9.19		42.61	45090.65	1.37	22%
Puglia	568	39%	11.98		73.92	62869.79	1.18	32%
Basilicata	278	27%	6.36		32.40	83415.37	0.46	33%
Calabria	581	15%	2.58		33.34	75424.23	0.28	20%
Sicilia	850	25%	6.82		34.56	77681.65	0.86	29%
Sardegna	321	22%	4.56		35.17	55716.47	0.71	20%

Empirical model / the intensive and the extensive margin

The extensive margin model:

$$\Pr(Export_{irst} = 1) = \Pr(\alpha_i + \beta inn_{irst-2} + \delta prod_{irst-2} + \gamma R\&D_{irst-2} + \mu X_{irst-2}$$

$$reg\_d + ind\_d + time\_d + \varepsilon_{irst}) =$$

$$= \Phi(\alpha i + \beta inn_{irst-2} + \delta prod_{irst-2} + \gamma X_{irst-2} + reg\_d + ind\_d + time\_d + \varepsilon_{irst})$$

The intensive margin model:

$$\text{Export on sales} = \alpha_i + \beta inn_{irst-2} + \delta prod_{irst-2} + \gamma R\&D_{irst-2} + \mu X_{irst-2}$$

$$reg\_d + ind\_d + time\_d + \varepsilon_{irst} =$$

i=firm
r= 20 regions
s=12 sectors
t= 2009, 2011, 2013

X is a set of firm controls

All explanatory factors are in log

Empirical model / the variables

Dependent variables

Pr(*Export*$_{irst}$): dummy which takes value one when the firm exports and zero otherwise

Export on sales (%)

Independent variables

- *Inn:* dummy which takes value one when the firm innovates and zero otherwise
  - *Inn prod (product innovation)*
  - *Inn proc (process innovation)*
  - *Inn org (organisation innovation)*
- *Prod:* value added on employees
- *R&D:* expenditure on R&D over sales

- ***X*** includes:
  - *Leverage*
  - *Age*
  - *Dimension*
  - *Group*
  - *Local network*
  - *Graduates* (not reported because it reduces significantly the sample dimension)

Dummies

reg_d

ind_d

time_d

Main hypothesis

1) We try to assess the role of experience and learning by including the lag of the dependent variable in the model

2) We try to go beyond the use of dummies to take into account potential regional or sectoral features which may influence firms' ability to export. We explore some potential indicators:

Regional level

- *R&D/GDP*
  - *Pub R&D/GDP*: quota of public R&D expenditure on region i GDP
  - *Priv R&D/GDP* : quota of private R&D expenditure on region i GDP

- *reg_RD_share:* quota of firms investing in RD within the region i

- *Population density:* inhabitants over squared KM
- *Human capital:* share of graduates on population

Sectoral level

- *sec_RD_share:* quota of firms investing in RD within the sector s

Estimation method

Extensive model

Dynamic Logit/Probit model

- corrected for initial conditions (Wooldridge, 2005)

- with clustered standard errors

Intensive model

- OLS model

- Fractional logit (since the dep. var is bounded 0-1)

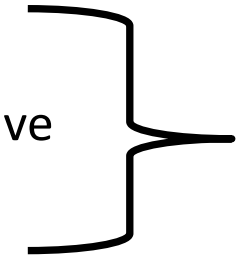
- Zero One Inflated Beta model (since the process which generates the null values may be different with respect to the one which gives rise to positive values)

Not done yet

Estimation strategy

Estimation stages:

1. Estimate the benchmark model...
2. Extension to select the preferred model.
3. Test for robustness with respect to alternative measures and subsamples.
4. Post-estimation stage
   - assess the conditional probability of exporting



we are still here in between phase 2 and 3

Logit/Probit model: extensive margin

	Logistic regression						Probit regression	
	Coef.	P>|z|	Coef.	P>|z|	Coef.	P>|z|	Coef.	P>|z|
export_D_LAG			2.78	*0.00*	2.78	*0.00*	1.67	*0.00*
inn_all	0.26	*0.00*	0.10	*0.03*	0.11	*0.03*	0.06	*0.03*
ln_rd	0.05	*0.00*	0.01	*0.00*	0.01	*0.00*	0.01	*0.00*
ln_prod	0.19	*0.00*	0.20	*0.00*	0.21	*0.00*	0.12	*0.00*
ln_leverage	-0.07	*0.00*	-0.05	*0.01*	-0.05	*0.02*	-0.03	*0.02*
ln_size	0.29	*0.00*	0.18	*0.00*	0.18	*0.00*	0.10	*0.00*
ln_age	-0.07	*0.04*	-0.04	*0.20*	-0.80	*0.00*	-0.45	*0.00*
group	0.21	*0.00*	0.06	*0.34*	0.06	*0.34*	0.03	*0.32*
local_network	-0.12	*0.00*	-0.04	*0.35*	-0.04	*0.35*	-0.02	*0.33*
dymanic correction					0.79	*0.00*	0.44	*0.00*
SECT	yes		yes		yes		yes	
REG	yes		yes		yes		yes	
T	yes		yes		yes		yes	
Pseudo R2	0.14		0.35		0.35		0.35	
Number of obs	16541		16541		16541		16541	

(Std. Err. adjusted for 11169 clusters in id)

Logit models – extensions and robustness exercises/1

	Logistic regression							
	Coef.	P>|z|	Coef.	P>|z|	Coef.	P>|z|	Coef.	P>|z|
export_D_LAG	2.78	*0.00*	2.78	*0.00*	2.79	*0.00*	2.79	*0.00*
prod_inn_p	0.13	*0.05*	0.14	*0.03*				
proc_inn	0.01	*0.88*			0.05	*0.35*		
org_inn	0.03	*0.64*					0.05	*0.35*
ln_rd	0.01	*0.01*	0.01	*0.00*	0.01	*0.00*	0.01	*0.00*
ln_prod	0.21	*0.00*	0.21	*0.00*	0.21	*0.00*	0.21	*0.00*
ln_leverage	-0.05	*0.02*	-0.05	*0.02*	-0.05	*0.02*	-0.05	*0.02*
ln_size	0.18	*0.00*	0.18	*0.00*	0.18	*0.00*	0.18	*0.00*
ln_age	-0.79	*0.00*	-0.79	*0.00*	-0.80	*0.00*	-0.79	*0.00*
group	0.06	*0.32*	0.06	*0.31*	0.06	*0.33*	0.06	*0.33*
local_network	-0.04	*0.39*	-0.04	*0.41*	-0.03	*0.47*	-0.03	*0.46*
dymanic correction	0.78	*0.00*	0.78	*0.00*	0.78	*0.00*	0.78	*0.00*
SECT	yes		yes		yes		yes	
REG	yes		yes		yes		yes	
T	yes		yes		yes		yes	
Pseudo R2	0.35		0.35		0.35		0.35	
Number of obs	16541		16541		16541		16541	

(Std. Err. adjusted for 11169 clusters in id)

Logit models – extensions and robustness exercises/2

	Coef.	P>|z|		Coef.	P>|z|		Coef.	P>|z|
export_D_LAG	2.79	0.00		3.64	0.00		3.65	0.00
inn_all	0.11	0.02		0.11	0.03		0.11	0.02
ln_rd	0.01	0.00		0.01	0.00		0.01	0.00
ln_prod	0.20	0.00		0.24	0.00		0.24	0.00
ln_leverage	-0.05	0.02		-0.05	0.02		-0.05	0.02
ln_size	0.17	0.00		0.18	0.00		0.18	0.00
ln_age	-0.76	0.00		-0.80	0.00		-0.77	0.00
group	0.06	0.27		0.05	0.37		0.05	0.41
local_network	-0.04	0.39		-0.04	0.33		-0.04	0.32
dymanic correction	0.75	0.00		0.79	0.00		0.76	0.00
ln_rd_pub_gdp	-0.41	0.24	reg_RD_share	0.16	0.02	reg_RD_share	0.16	0.03
ln_rd_priv_gdp	0.94	0.00				sec_rd_share	0.30	0.02
SECT	yes			yes			yes	
REG	yes			yes			yes	
T	yes			yes			yes	
Pseudo R2	0.14			0.35			0.35	
Number of obs	16541			16541			16541	

(Std. Err. adjusted for 11169 clusters in id)

Logit models – extensions and robustness exercises/3

	Logistic regression							
	Coef.	P>|z|	Coef.	P>|z|		Coef.	P>|z|
export_D_LAG	3.61	0.00	3.66	0.00		3.72	0.00
inn_all	0.15	0.02	0.11	0.02			
inn_all_exp_D_LAG	-0.09	0.33					
					prod_inn_p	0.28	0.00
					prod_inn_p_exp_D_LAG	-0.29	0.02
					proc_inn	0.02	0.85
					proc_inn_exp_D_LAG	0.00	0.99
					org_inn	0.01	0.86
					org_inn_exp_D_LAG	0.03	0.82
ln_rd	0.02	0.01	0.01	0.00		0.01	0.00
ln_rd_exp_D_LAG	-0.01	0.34					
ln_prod	0.23	0.00	0.23	0.00		0.23	0.00
ln_prod_exp_D_LAG	-0.08	0.07	-0.08	0.07		-0.09	0.06
dymanic correction	0.74	0.00	0.74	0.00		0.74	0.00
ln_leverage	-0.05	0.02	-0.05	0.02		-0.05	0.02
ln_addetti	0.18	0.00	0.18	0.00		0.18	0.00
ln_age	-0.76	0.00	-0.76	0.00		-0.75	0.00
group	0.06	0.30	0.06	0.29		0.06	0.29
local_network	-0.04	0.37	-0.04	0.39		-0.04	0.40
ln_rd_pub_gdp	-0.42	0.23	-0.42	0.24		-0.43	0.23
ln_rd_priv_gdp	0.94	0.00	0.94	0.00		0.96	0.00
Pseudo R2	0.35		0.35			0.36	
Number of obs	16541		16541			16541	

(Std. Err. adjusted for 11169 clusters in id)

Regional, Sectoral and Time dummies are included

OLS models – intensive margin

	OLS regression			
	Coef.	P>|t|	Coef.	P>|t|
export_SH_LAG			0.5871	0.0000
inn_all	0.0182	0.0000	0.0086	0.0090
ln_rd	0.0050	0.0000	0.0009	0.0070
ln_prod	0.0153	0.0000	0.0101	0.0000
ln_leverage	-0.0082	0.0000	-0.0047	0.0000
ln_size	0.0293	0.0000	0.0120	0.0000
ln_age	-0.0301	0.0870	-0.0303	0.0430
group	0.0254	0.0000	0.0008	0.8460
local_network	-0.0197	0.0000	-0.0049	0.0910
dymanic correction	0.0245	0.1760	0.0274	0.0730
reg_RD_share	0.0006	0.8980	0.0017	0.6810
sec_RD_share	0.0044	0.6190	0.0146	0.0720
R-squared	0.1690		0.4435	

Main results and preliminary conclusions

- As in previous contributions we find out that probability to export depends on some specific features
  - ***Productivity***, first of all, but also *Size*, *Age* and *Leverage*. No robust effect is on the contrary found for *Group* or *Local network*

- Firm export performance depends significantly on its *innovative* activity both in terms on input (***R&D expenditure***) and output (***innovativeness***)

- As far as the latter aspect, **product innovation** always proves significantly correlated to export whilst process and organization innovation are never significant

- There is quite an important **learning to export** effect in general and more specifically this effect may determine a different impact of productivity and of product innovation on export: if a firm is not an exporter the impact of productivity and of product innovation is much stronger

Main results and preliminary conclusions

- As in previous contribution there is a role for some specific regional effects which go beyond the catch-all influence of dummy variables
  - In particular we find that **private R&D** has a positive and significant effect whilst public R&D has a negative even though not significant impact
  - When we consider the quota of firms which invest in **R&D at the regional** level we again find a positive and significant effect
  - Other potential regional spillovers due to human capital or agglomeration phenomena have not been found, at this stage, significant

- There is also a role for some specific **sectoral effects due to R&D** which go beyond the catch-all influence of dummy variables.

Extensions

- There are several other potential issues of interest which are currently not yet explored:
  - Explore further the regional and sectoral dimension
  - Explore the role for region-sector determinants
  - Explore the role of geographical position: border, central, peripheral regions
  - Dummy macro-regions (NUTS1) and macro-sector (PAVITT)
  - Before and during the crisis performance

- Fractional Logit models and ZOIB (Zero One Inflated Beta) model

- Compute conditional probabilities