Heterogeneous Shocks in the COVID-19 Pandemic: Panel Evidence from Italian Firms

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Background

- COVID-19 pandemic is unprecedented combination of demand and supply shocks for the global economy.
- Early stages: full effects far from being realized.
- Prompt measures in support of the economy are paramount to limit the disruption of the key segments of the market and help firms to weather the storm.

Contribution to the policy discussion

- Present real-time evidence on the magnitude of the shock faced by Italian companies.
- Difficulties in proxying the COVID-induced shock.
- Exploit revision in expectations on future outcomes within a 2-months window to proxy for firms' idiosyncratic shock.
- Short-window identification strategy: panel of Italian firms between
  - January 2020: just before the outbreak of the pandemic (February);
  - end-of March 2020, in the midst of lockdown policies.
- Document significant heterogeneities along firms' characteristics, past strategies, and behaviors.

Focus on Italy is instructive

- Italian economy severely hit by the pandemic.
- Significant heterogeneity in the geographical spread of the virus.
- First Western country to implement lockdown policies.
- Structural characteristics: SMEs a priori more exposed to adverse shocks and more financially constrained.

Data

- Pre-COVID: 2019-MET survey (January 2020).
  - 24,000 firms representative at regional, industrial (2D), and size class levels (including micro-sized companies).
  - Expectations on future sales and scheduled R&D projects (12 months).
  - Large set of information on: structural characteristics, financial issues, and strategic behaviors (internationalization, innovativeness, and R&D).
  - Comprehensive snapshot of firms' conditions in entering the pandemic.
- Post-COVID: ad hoc updating survey (panel information).
  - 2 weeks administration (March 24-April 7), 13 days after lockdown policies.
  - 33% response rate, 7,800 firms in the final sample.
  - Coherent questions on expected future sales and R&D future plans (comparability).
  - Additional queries on (continuous) perceived change in expectations about sales at 3 and 12 months, employment, investment in tangible and intangible assets (all at 12 months).
- Balance sheet data (CRIF-Cribis D&B).

Econometric methodology: pseudo Diff-in-diff

$$Y_{i,t} = \alpha + \beta \mathbb{E}_{i,t-1}(\text{Sales1Y}) + \gamma^\top X_{i,t-1} + \delta^\top Z_{i,t-1} + \lambda_S + \lambda_P + \varepsilon_{i,t}$$

- $Y_{i,t}$:
  - revision in expectations on sales at 12 months (coherent questions)
  - revision in future R&D plans 12 months (coherent questions)
  - reported revision on expected sales (3 and 12 months), employment, investment in tangible and intangible assets.
- $X_{i,t-1}$ pre-COVID strategies (predetermined): internationalization, innovativeness (product and process), R&D.
- $Z_{i,t-1}$: size, age, share of graduated employees, labor productivity, degree of vertical integration, a set of financial ratios (leverage, tangible assets, and rollover risk) and dummies for investment, corporate group belonging, or family managed firms.
- λ_S and λ_P: fixed effects for the belonging sector (2-Digit, 90 controls) and geographical province (107) of the company.

Results: coherent questions on sales

Model:	OLS		Ordered Logistic	
Dependent Variable:	$\mathbb{E}_{i,t}$(Sales1Y)	$\Delta\mathbb{E}_{i,t}$(Sales1Y)	$\mathbb{E}_{i,t}$(Sales1Y)	$\Delta\mathbb{E}_{i,t}$(Sales1Y)
	(1)	(2)	(3)	(4)
Internationalization	-1.150***	-0.168***	-0.525***	-0.467***
	[0.409]	[0.0557]	[0.156]	[0.151]
R&D	0.971*	0.138**	0.349**	0.359**
	[0.510]	[0.0684]	[0.176]	[0.182]
Product Innovation	-1.158***	-0.168***	-0.405***	-0.440***
	[0.439]	[0.0548]	[0.155]	[0.162]
Process Innovation	0.0991	0.0200	0.0382	0.00830
	[0.512]	[0.0655]	[0.179]	[0.185]
$\mathbb{E}_{i,t-1}$(Sales1Y): Very Negative	-3.591***	1.425***	-2.455***	3.822***
	[0.753]	[0.109]	[0.477]	[0.301]
$\mathbb{E}_{i,t-1}$(Sales1Y): Negative	-1.985***	0.696***	-0.986***	1.653***
	[0.451]	[0.0595]	[0.189]	[0.178]
$\mathbb{E}_{i,t-1}$(Sales1Y): Positive	1.125*	-0.865***	0.340*	-2.351***
	[0.615]	[0.0757]	[0.195]	[0.253]
$\mathbb{E}_{i,t-1}$(Sales1Y): Very Positive	4.005***	-1.526***	0.974**	-4.450***
	[1.352]	[0.164]	[0.383]	[0.527]
Leverage	-0.023**	-0.003**	-0.0101**	-0.008**
	[0.0102]	[0.0013]	[0.0049]	[0.003]
Tangible Assets	2.529**	0.362**	0.794**	0.952**
	[1.257]	[0.154]	[0.404]	[0.425]
Rollover risk	-1.998*	-0.307**	-0.644*	-0.817**
	[1.032]	[0.137]	[0.353]	[0.398]
Size	1.153***	0.146***	0.385***	0.394***
	[0.162]	[0.0190]	[0.0502]	[0.0533]
Age	-0.811***	-0.103***	-0.270***	-0.273***
	[0.288]	[0.0338]	[0.0903]	[0.0943]
Province FE	yes	yes	yes	yes
Industry (2 Digit) FE	yes	yes	yes	yes
N obs.	5071	5071	5071	5071
R2 (Pseudo R2)	0.217	0.427	0.129	0.207

Results: reported revisions on broader issues

Dependent Variable:	(1) $\Delta\mathbb{E}^R_{i,t}$(Sales3M)	(2) $\Delta\mathbb{E}^R_{i,t}$(Sales12M)	(3) $\Delta\mathbb{E}^R_{i,t}$(Empl12M)	(4) $\Delta\mathbb{E}^R_{i,t}$(Tang12M)	(5) $\Delta\mathbb{E}^R_{i,t}$(Intang12M)
Internationalization	-6.161***	-4.523***	-2.983*	-5.456**	-4.314*
	[1.791]	[1.660]	[1.756]	[2.091]	[2.194]
R&D	0.960	0.723	3.083*	0.104	1.372
	[1.355]	[1.385]	[1.829]	[2.998]	[2.077]
Product Innovation	-4.196***	-3.488**	-0.863	-2.061	-2.099
	[1.577]	[1.438]	[2.031]	[2.133]	[2.545]
Process Innovation	1.050	1.288	1.585	1.025	4.515**
	[1.970]	[1.443]	[1.509]	[2.647]	[2.170]
$\mathbb{E}_{i,t-1}$(Sales1Y)	3.738***	4.030***	5.011***	5.950***	4.857***
	[1.055]	[0.852]	[1.502]	[1.581]	[1.451]
Province FE	yes	yes	yes	yes	yes
Industry (2 Digit) FE	yes	yes	yes	yes	yes
R2	0.188	0.187	0.213	0.105	0.170
N	5071	5104	5070	5067	5066

Aggregate effects

Aggregate effects computed as:

$$g = \frac{\sum_{i=1}^{N} w_i O_{i,t} \Delta \mathbb{E}_{i,t}^{R}(\mathrm{O}_{i,t+\tau})}{\sum_{i=1}^{N} w_i O_{i,t}}.$$

Impact of firm-specific strategy on aggregate shock:

- Compute counterfactual revision in expectation in absence of strategy X (from previous estimates):

$$\hat{g}_{|X=0} = \frac{\sum_{i=1}^{N} w_i O_{i,t} \left(\Delta \mathbb{E}_{i,t}^{R}(O_{i,t+\tau}) - \hat{\delta}_x X_{i,t-1} \right)}{\sum_{i=1}^{N} w_i O_{i,t}}.$$

- Taking the difference to derive aggregate contribution:

$$g - \hat{g}_{|X=0} = \frac{\sum_{i=1}^{N} w_i O_{i,t} \hat{\delta}_x X_{i,t-1}}{\sum_{i=1}^{N} w_i O_{i,t}}.$$

Aggregate effects

	Sales 3M	Sales 1Y	Empl1Y
g	-21.18%	-16.11%	-6.43%
$g - \hat{g}_{\|\text{Internationalization}=0}$	-5.15%	-2.77%	-0.31%
$g - \hat{g}_{\|\text{R\&D}=0}$	+0.52%	+0.38%	+1.41%
$g - \hat{g}_{\|\text{Product Inn}=0}$	-2.55%	-2.07%	-0.42%
$g - \hat{g}_{\|\text{Process Inn}=0}$	+0.54%	+0.65%	+0.69%

- Sharp reduction in aggregate future sales: 21%-expected drop on a 3-months horizon and still pessimistic dynamic at 12 months (-16%).
- Far from the V-effect hypothesized (asymmetric-V approaching a L-effect).
- Employment drops only by *only* 6.5%. Early stage of the crisis, widespread uncertainty, postponement of firing decisions (vacation leaves and wage-guarantee funds).
- Internationalization explains a sizable fraction of the shock (25% and 17% at 3 and 12 months).
- Product innovations still very sizable (12% overall).

Long-run effects on R&D future plans

Revision in expectations may not be accurate, but still drives current decisions.

Change in future R&D plan:	(-1) Cancelled	(0) Unaffected	(+1) New Plans
Internationalization	0.0381*	0.00372	-0.00105
	[0.0206]	[0.0218]	[0.00809]
R&D	0.144***	-0.0915***	-0.0529***
	[0.0294]	[0.0341]	[0.0199]
Product Innovation	0.0692**	-0.0906***	0.0214
	[0.0275]	[0.0278]	[0.0162]
Process Innovation	0.00800	-0.0353	0.0273
	[0.0315]	[0.0306]	[0.0220]
Province FE		yes	
Industry (2 Digit) FE		yes	
N obs.		5071	
Pseudo R2		0.201	

Concluding remarks

Contribute to the policy discussion by showing relevant heterogeneities in the shock experienced by Italian companies.

- Immediate need for liquidity and support to the financial structure.
- Relevant heterogeneities in the magnitude of the shock:
  - internationalization: related to the large uncertainty about international economic relationships and world trade;
  - firms' innovativeness: increased uncertainty about returns from innovations (already uncertain in normal times) & fear of a permanent change in consumption habits.
- Likely to better adapt to the fast-evolving scenario, but in the meantime effects on current choices can further depress long-run growth.

Additional heterogeneities

- Stronger effects for more complex internationalization (FDIs, delocalization, and R&D-oriented international cooperation).
- For simple internationalization: main effect of import from extra-EU countries (Global Value Chain).
- Radical vs. imitative product or process innovations: entire driven by truly-innovative goods.

Robustness

- Control for manager's expectation on the length and severity of the crisis (e.g., expectations on length of lockdown).
- Control for the exact day of a manager's answer (also specific for geographical regions and sectors).
- Control for essential sectors (relevant effects).
- Alternative clustering of the standard errors: province level, 5-Digit sector level (766), or at the intersection of 2-Digit sector and geographic region (772).