Macroeconomic effects of the SARS-CoV-2 disease

Results from DSGE model simulations and S-BVAR-based forecasts

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Plan of the presentation

- Two approaches, theory based vs data-based simulations
- Some prior and (hopefully) posterior information about the state of the macroeconomy
- Theory-based simulations: hints on model and scenarios, results
- Forecasting without theory: a S-BVAR for high frequency information sets, results
- Some (in)conclusive policy considerations

Two approaches

- As of March 26, 2020, information about the economic effects of the pandemic was not available. The Italian ministry of the economy, on March 24, declared the expected contraction to be of few pps, serius yet manageable. With more than 80k COVID19 registered cases, increasing at a rate still above 8%, and the economy in nearly complete lock-down there was the feeling that the pandemic whould hit seriously.
- Need to conceptualize the kind of (economic) shock(s) the pandemic whould produce, build scenarios for their size and time profile, then use them to hit a theoretical model lying on its steady state solution. This model is a symmetric, two-country, NOEM-DSGE for the EZ
- As of June 10, 2020, high frequency information about the early macroeconomic effects is available from LF statistics, leading indicators, confidence surveys, market data on interest rates and stock prices. Need to standardize these variables, set-up an econometric strategy able to deal with a quite large information set observed at the monthly and daily frequency. This strategy relies on a SBVAR

Macroeconomic data what we knew since March 26?

Registered Y-o-Y variations at differnt points in time since Jan 2020 (%)

Variable	2020:01	2020:02	2020:03	2020:04
Employment (all)	0.14	0.12	-0.97	-2.13
Employment (15-34)	-1,65	-1.86	-7.84	-12.14
GDP	-0.14*	-0.44*	-5.04	-10.43*
GDP price index	1.12	0.98	0.88	0.89
Industrial production index	0.28	-1.95	-31.30	-38.76
Retail sales index	0.99	2.30	-21.16	-30.81
Composite leading indicator	0.34	0.46	-0.96	-2.41
Business confidence leading indicator	-0.33	-0.49	-0.97	-1.49
Consumer confidence leading indicator	-0.59	-0.74	-1.25	-1.84
Interest rate (lending to NFC)	-0.08	-0.10	-0.11	0.06
Interest rate (10Y BTP)	-1.50	-1.85	-1.14	-0.82
Stock price index	22.18	18.44	-16.56	-20.12

Source: OECD-MEI - Istat-RCFL for employment variables.

Note: * denotes interpolated data

Theory-based simulations: the model

- Monetary NOEM-DSGE model, home and foreign sector in symmetric representation (Italy vs. EZ); parameter space partially estimated/calibrated
- Rational agents (heterogeneous consumers, a fraction suffer liquidity constraints): households, firms, unions,wholesale and retail exporters and importers
- Policies: locally managed fiscal policy, centralized fiscal policy
- Imperfectly competitive goods, bank and labor markets; nominal price/wage rigidities; real rigidities in consumption, accumulation, capacity adjustment
- Detail representation of fiscal policy; representation of sovereign risk (interest rate differential are a function of B/Y e NFA/Y ratios)

Model properties: fiscal multipliers

- Dynamic monetary multipliers for temporary (two years) and permanent 1% GDP policy shocks. Deterministic simulation (agents are perfectly informed about the size and time profile of the shock)

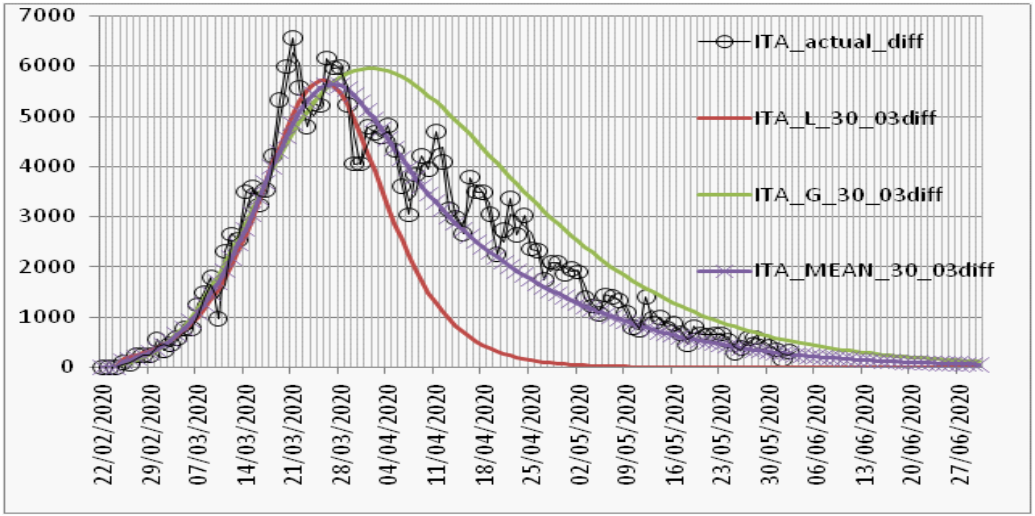
Dynamic monetary multipliers - by fiscal policy instrument (1% GDP)

Time horizon.	1Q		4Q		8Q		20Q	
Interv./duration	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm
Gov consumption	1.53	1.51	1.80	1.73	1.93	1.68	1.19	0.84
Gov. investment	1.05	0.42	2.38	0.89	3.16	1.21	3.21	1.10
Gov. transfers	0.49	0.48	0.56	0.53	0.61	0.50	0.39	0.26
Labor taxes	0.51	0.53	0.55	0.62	0.63	0.70	0.64	0.76
Profit taxes	0.12	0.25	0.24	0.60	0.26	0.94	0.27	1.15
Cons/import taxes	0.43	0.44	0.52	0.53	0.61	0.57	0.47	0.43

Source: Model's simulations at the estimated/calibrated parameterization

Assumption # 1: the COVID-19 spread (as of March 26, 2020)

Projected newly registered cases under two alternative diffusion models



Source. forward simulation of Logistic and Gompertz diffusion eq.s estimated on March, 26 case data

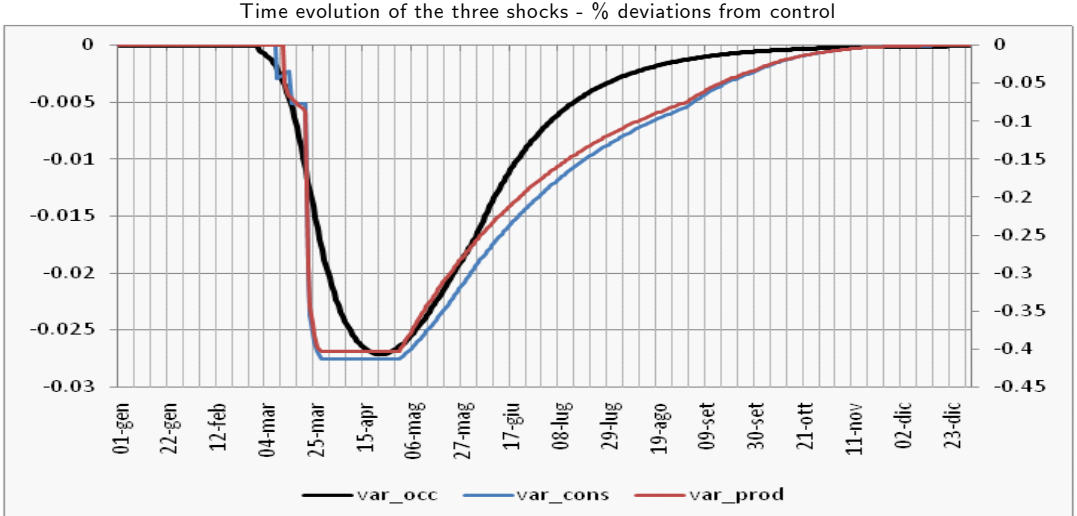
Assumption # 2: the size and evolution of containment measures (as of March 26, 2020)

- I use data from Istat's I/O tables and consumption survey and take note of the sectors and relative value affected by the lock down measures
- I assume that sectors in which some producers are allowed to operate on the basis of extraordinary permissions, 15% of potential is activated.
  Production/consumption of essential sectors increases by 10%. Remaining sectors are completely shut-down
- I assume that the lock-down remains in force until active cases reach their peak (i.e. May 4, 2020), then relaxed according to the projected spread. The peak point and the active cases' time profile are estimated on the basis of the mean of two projections obtained from estimated diffusion eq (Logistic and Gompertz), with population re-scaling obtained by assuming an age-adjusted CMR of 0.9% (Diamond Princess ship spread taken as evidence in population), given the observed CFR. Given MRs and an average RRs of four weeks, the active cases dynamics is obtained

Assumption # 3: mapping active cases into three economic shocks

- The labor supply shock is obtained from the age-adjusted estimated active cases (in population), considering official CD by age class (ISS data)
- The production supply shock (operated capital) is obtained from the estimated value of the production loss obtained from I/O data at the peak of the lock-down (nearly 39% of VA), then relaxed according to the projected abatement of active cases
- The demand shock (preferences) is obtained from the estimated value of the production loss obtained from consumption data at the peak of the lock down (nearly 36% of VA), then relaxed according to the projected abatement of active cases
- I assume that these shocks are known in advance (deterministic simulation to avoid model stability problems)

The three shocks - % deviations from control



Note: The operated capital and preference shocks are measured on the right scale

Assumption # 4: policy responses, as of March 26

- The simulation considers three scenarios:
- S1: No fiscal policy intervention except for authomatic PLMPs (nearly 10b. euro per month); monetary policy expansive with full use of PEPP (as of March, 26 - 750b euro) until reaching national capital key
- S2: Fiscal policy scenario: PLMPs active; as of March 26, a discretionary recovery package of about 20b euro was planned. Two additional packages of 25b euro each, to be implemeted in the second and third quarter. A total of 70b euro are thus considered as discretionary measures, of which 75% are spent in transfers to households and firms, 25% in government consumption. Fiscal policy is thus expansionary for about 5,2% of GDP (90b)
- S3: Same as S2 but considering illimited action by the CB for asset purchases (implemented considering a natural interest rate target rule)

Results from scenario simulations

Simulation results for dec 2020 - % deviations from trend

	Output - fiscal outlook - value added						Labor stock				
Sc.	GDP	B/Y	YAgr	YInd	YCon	YServ	NTot	NAgr	NInd	NCon	NServ
S1	-13.7	21.1	-6.2	-23.8	-36.6	-9.9	-9.3	-7.3	-4.3	-22.8	-9.7
S2	-9.4	19.9	-3.9	-15.9	-26.0	-6.8	-6.3	-4.0	-2.9	-15.5	-6.6
S3	-6.2	15.0	-2.0	-9.6	-17.8	-4.5	-4.4	-2.7	-2.0	-10.8	-4.6

Source: Model's simulations at the estimated/calibrated parameterization

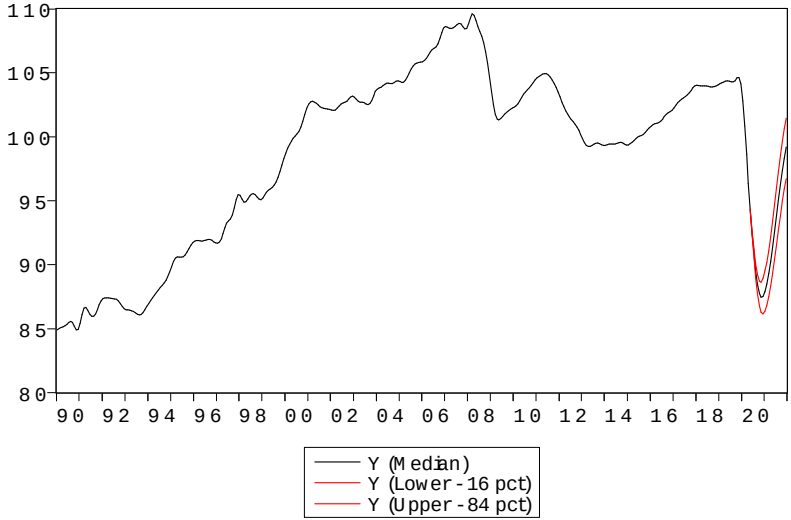
Forecasting without theory: use of high frequency data in VAR

- As of June 10, high-frequency macro data are few, yet available (Table 1). Model-based simulations can be confronted with "early" forecasts from estimated log-linearized representations of the JDD
- I include cubic spline-interpolated GDP and montlhy labor indexes in a VAR considering the entire set of 2020:m4 avilable leading indicators
- Due to the dimensionality issue with large VARs, I estimate the model with Bayesian techniques and exploit Sims and Zha's (2006) Litterman/Minnesota-like prior restrictions to shrink the parameterization (Banbura, *et al.*, 2010; Carriero, *et al.*, 2012; Koop, 2013):

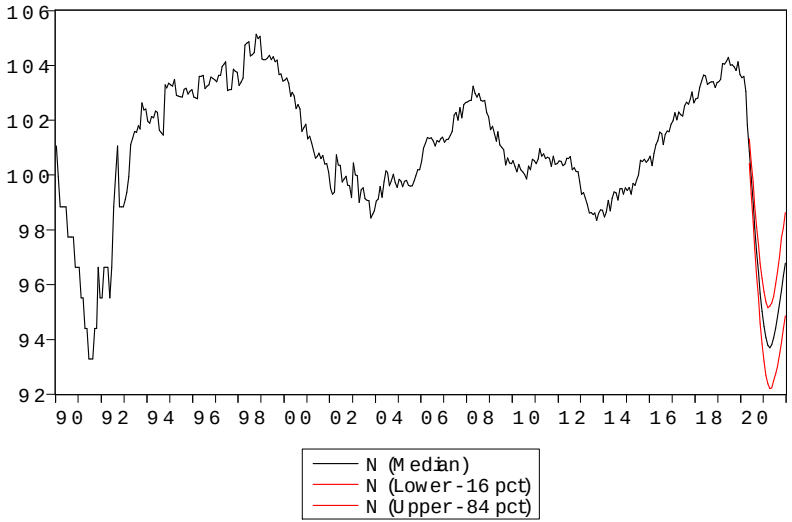
$$y_t^{'} A_0 = c + \sum_{i=1}^{\rho} y_{t-i}^{'} A_i + \epsilon_t^{'} \Sigma^{-1}$$

where $y_t' = \left[\begin{array}{cccccccccccc} n_t & n_t^y & y_t & p_t^y & ip_t & rs_t & cli_t & bci_t & cci_t & r_t^g & r_t^b & sp_t \end{array} \right]$ is the 12-dimensional vector of endogenous variables, $\mathbf{c}$ is the vector of constants, A_0 is the invertible contemporaneous correlations matrix, A_i the dynamic cross-correlation matrices for each lag term ρ, and Σ is a diagonal matrix.

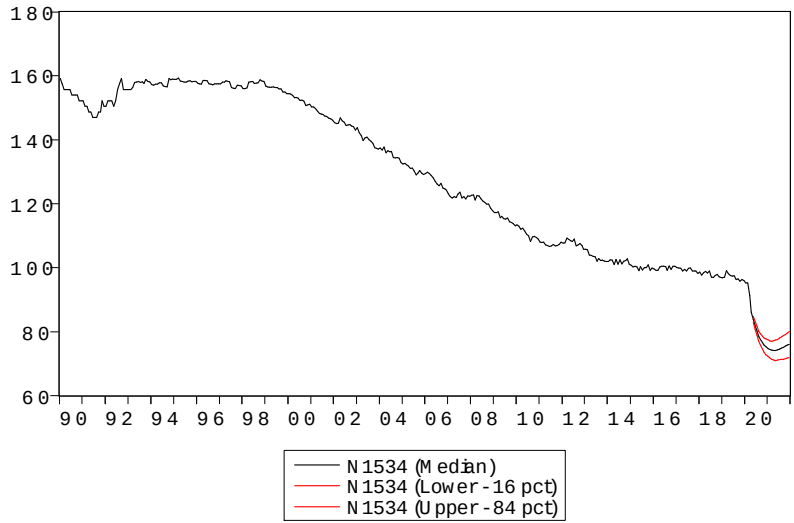
BVAR forecasts May.20 - Dec.12 - GDP (2020: -15.8%; 2021: 13.3%)



BVAR forecasts May.20 - Dec.12 - EmplTot (2020: -7.8%; 2021: 1.4%)



BVAR forecasts May.20 - Dec.12 - Empl1534 (2020: -21.6%; 2021: 1.6%)



(in)Conclusive policy considerations

- At the end of 2020, the DSGE model-based expected contraction in real activity is between 13.7 and 6.2 pp. These figures are conditional on the model structure, the hypothesized size and time profile of the shocks and on the different policy scenarios
- BVAR-based forecasts point to a GDP contraction between 17 and 15 pp. Will policy succeed in taking macroeconomic dynamics closer to the model-based forecast? We are not too far from getting an answer - wait and see

Simulated/forecasted GDP levels 2020 (2019=100)

	DSGE (policy act)			BVAR (no policy act)		
Sc./pct	Low	Mid	High	Low	Median	High
Level	86.3	90.6	93.8	82.8	84.0	85.4

Source: Model's simulations at the estimated/calibrated parameterization

(in)Conclusive policy considerations

- Outside the ECB's Pandemic Emergency Purchasing Programme (PEPP), the Recovery fund and the labor market-targeted SURE are still in a projectual stage, and the health system-targeted "relaxed conditions" ESM still suffers, aside from its own reputation, from potential pitfalls that are independent from conditionality issues.
- At present, national governments' debt issuing on the supply side, ECB and resident's asset purchases on the demand side, are doing the whole job
- The way these measures will be financed and implemented is key for their success
- Will the market be sufficiently thick to absorb the unprecedented amount of debt from new issuing (from government and EU institution) and renewals of old stocks at reasonable yelds?
- If not, will the CB purchase from the perspective institutional lenders?
- How, where and when will these perspective resources be spent?