

Appendices

Appendix A. IS descriptive statistics

Table A1.: Name and frequency (m=monthly, q= quarterly, h-y=half-yearly) of the considered variables together with the related identification code of used in label nodes

Label node	Variable Name	Frequency	ARIMA(p,d,q)
1	<i>Number of IS</i>	h-y	
2	<i>Percentage of the 1st requirement (t - 1)</i>	h-y	ARIMA(0,0,1)
3	<i>Percentage of the 2nd requirement (t - 1)</i>	h-y	ARIMA(1,1,0)
4	<i>Percentage of the 3rd requirement (t - 1)</i>	h-y	ARIMA(0,0,1)
5	<i>Percentage of IS in the North (t - 1)</i>	h-y	ARIMA(0,1,0)
6	<i>Percentage of IS in the South (t - 1)</i>	h-y	ARIMA(0,1,0)
7	<i>R&D</i>	q	ARIMA(1,1,1)
8	<i>IT companies value</i>	q	
9	<i>Business value of services</i>	q	ARIMA(1,1,0)
10	<i>Telecom business value</i>	q	ARIMA(1,0,1)
11	<i>Service turnover indices</i>	q	
12	<i>GDP</i>	q	ARIMA(1,0,0)
13	<i>Real residential Property Prices</i>	q	ARIMA(0,2,1)
14	<i>Unemployment Rate</i>	m	ARIMA(0,1,0)
15	<i>Total business confidence</i>	m	ARIMA(0,1,1)
16	<i>Tourism-seasonally adjusted data-Arrivals</i>	m	ARIMA(2,1,2)
17	<i>Tourism-seasonally adjusted data-Departures</i>	m	
18	<i>Trust Business services</i>	m	
19	<i>Building producer price indices</i>	m	ARIMA(2,2,1)
20	<i>Imports</i>	m	ARIMA(2,1,2)
21	<i>Exports</i>	m	ARIMA(0,1,0)
22	<i>Industrial production index</i>	m	ARIMA(1,0,1)
23	<i>Consumer price index of all items</i>	m	ARIMA(2,1,0)
24	<i>Import price index</i>	m	ARIMA(1,2,1)
25	<i>Index political stability</i>	m	ARIMA(0,1,2)
26	<i>Index wages</i>	m	ARIMA(0,2,1)
27	<i>Retail-food sales value index</i>	m	ARIMA(0,1,1)
28	<i>Non-food retail sales value index</i>	m	
29	<i>Milan Stock Exchange index</i>	m	
30	<i>Exchange Euro-Dollar</i>	m	
31	<i>Exchange Euro-Yen</i>	m	
32	<i>Oil price index</i>	m	
33	<i>Eni index</i>	m	
34	<i>National Grid plc</i>	m	
35	<i>Intesa San Paolo Index</i>	m	
36	<i>Unicredit Index</i>	m	
37	<i>Gold price Index</i>	m	
38	<i>Amazon price Index</i>	m	
39	<i>Google price Index</i>	m	
40	<i>Wheat price Index</i>	m	
41	<i>Netflix price Index</i>	m	
42	<i>Apple price Index</i>	m	

Table A2.: Number and relative percentage of IS for Regions active in 12-2021

Regionis	Number of IS	Percentage of IS
Abruzzo	303	2.02%
Basilicata	152	1.01%
Calabria	276	1.84%
Campania	1364	9.09%
Emilia-Romagna	1128	7.52%
Friuli-Venezia Giulia	276	1.84%
Lazio	1799	11.99%
Liguria	256	1.71%
Lombardia	4104	27.35%
Marche	410	2.73%
Molise	83	0.55%
Piemonte	806	5.37%
Puglia	698	4.65%
Sardegna	236	1.57%
Sicily	694	4.63%
Toscana	704	4.69%
Trentino-Alto Adige	331	2.21%
Umbria	240	1.60%
Valle D'Aosta	23	0.15%
Veneto	1121	7.47%
Total	15004	

Appendix B. Step 2: details on PCA

Table B1.: PCA for half-year frequency variables

Principal Component	PC1	PC2	PC3	PC4	PC5
Standard deviation	0.418	0.214	0.113	0.045	0.032
Proportion of Variance	0.739	0.195	0.054	0.009	0.004
Cumulative Proportion	0.739	0.933	0.987	0.996	1.000

Table B2.: PCA loadings for the variables with half-year frequency

Variables with h-y frequency	PC1	PC2
<i>Percentage of the 1st requirement</i>	0.286	0.718
<i>Percentage of the 2nd requirement</i>	-0.059	0.197
<i>Percentage of the 3rd requirement</i>	-0.109	0.109
<i>Percentage of IS in the North</i>	-0.519	0.633
<i>Percentage of IS in the South</i>	0.796	0.184

Table B3.: PCA for quarterly frequency variables

Principal Component	PC1	PC2	PC3	PC4	PC5
Standard deviation	13600	31.26	9.40	4.30	1.84
Proportion of Variance	1.00	0.00	0.00	0.00	0.00
Cumulative Proportion	1.00	1.00	1.00	1.00	1.00

Table B4.: PCA loadings for the variables with quarterly frequency

Variable with q frequency	PC1
<i>R&D</i>	1.16E-03
<i>Business value of services</i>	2.58E-04
<i>Telecom business value</i>	3.80E-06
<i>Real residential Property Prices</i>	-9.03E-05
<i>GDP</i>	1.00E+00

Table B5.: PCA for monthly frequency variables

Principal Component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
Standard deviation	2616020	7.666e+03	1289	6.78	4.08	2.93	1.55	0.79	0.53	0.33	0.27
Proportion of Variance	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cumulative Proportion	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table B6.: PCA loadings for the variables with monthly frequency

Variables with m frequency	PC1
<i>Tourism-seasonally adjusted data-Arrivals</i>	1.00E+00
<i>Building producer price indices</i>	-3.14E-07
<i>Exports</i>	8.95E-05
<i>Total business confidence</i>	2.13E-06
<i>Imports</i>	1.46E-04
<i>Consumer price index of all items</i>	-2.15E-07
<i>Import price index</i>	2.26E-07
<i>Industrial production index</i>	1.28E-06
<i>Retail-food sales value index</i>	-6.69E-07
<i>Index wages</i>	-3.04E-07
<i>Unemployment Rate</i>	1.84E-07

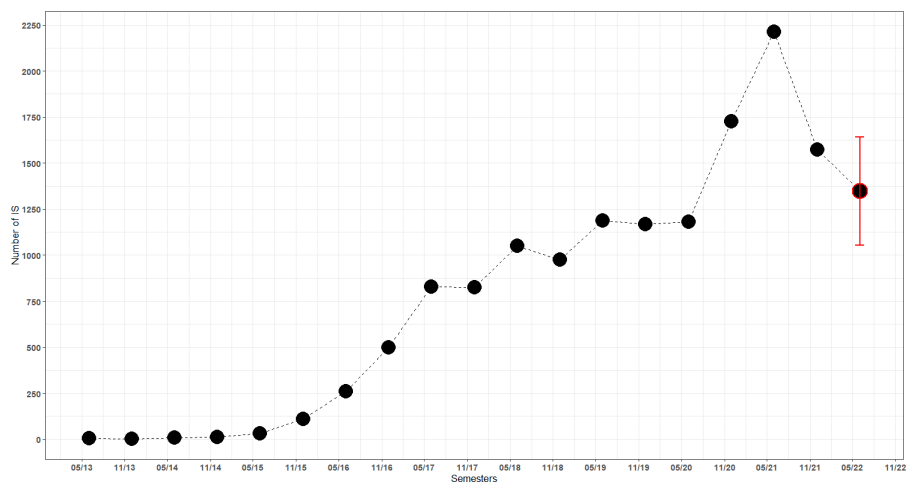


Figure B1.: Test performed by the optimal U-MIDAS model: in red the predicted values while the red bar represents the 95% confidence interval of the forecast

Appendix C. IS with high R&D investment (G1)

Table C1.: Path-steps EC for “Number of IS” of IS with high R&D investment

path-steps w_i	EC
w_1	-
w_2	0.084
w_3	0.109
w_4	0.122
w_5	0.136
w_6	0.156
w_7	0.161
w_8	0.157
w_9	0.143
w_{10}	0.138
w_{11}	0.136
w_{12}	0.128

Table C2.: PCA for half-year frequency variables for IS with high R&D investment

Principal Component	PC1	PC2
Standard deviation	0.40	0.14
Proportion of Variance	0.88	0.12
Cumulative Proportion	0.98	1.00

Table C3.: PCA loadings of the variables with half-year frequency for IS with high R&D investment

Variable with h-y Frequency	PC1	PC2
<i>Percentage of IS in the North</i>	0.57	-0.82
<i>Percentage of IS in the South</i>	-0.82	-0.57

Table C4.: PCA for quarterly frequency variables for IS with high R&D investment

Principal Component	PC1	PC2	PC3	PC4
Standard deviation	13600	28.99	4.35	1.85
Proportion of Variance	1.00	0.00	0.00	0.00
Cumulative Proportion	1.00	1.00	1.00	1.00

Table C5.: PCA loadings for the variables with quarterly frequency for IS with high R&D investment

Variable with q frequency	PC1
<i>R&D</i>	1.16E-03
<i>Telecom business value</i>	3.80E-06
<i>Real residential Property Prices</i>	-9.03E-05
<i>GDP</i>	1.00E+00

Table C6.: PCA for monthly frequency variables for IS with high R&D investment

Principal Component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
Standard deviation	2616020	7.666e+03	1289	58.76	6.73	3.622	2.847	1.462	0.7654	0.5211	0.3203	0.2702
Proportion of Variance	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cumulative Proportion	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table C7.: PCA loadings for the variables with monthly frequency for IS with high R&D investment

Variables with m frequency	PC1
<i>Tourism-seasonally adjusted data-Arrivals</i>	1.00E+00
<i>Building producer price indices</i>	-3.14E-07
<i>Exports</i>	8.95E-05
<i>Total business confidence</i>	2.13E-06
<i>Imports</i>	1.46E-04
<i>Index political stability</i>	-3.99E-06
<i>Consumer price index of all items</i>	-2.15E-07
<i>Import price index</i>	2.26E-07
<i>Industrial production index</i>	1.28E-06
<i>Retail-food sales value index</i>	-6.69E-07
<i>Index wages</i>	-3.04E-07
<i>Unemployment Rate</i>	1.84E-07

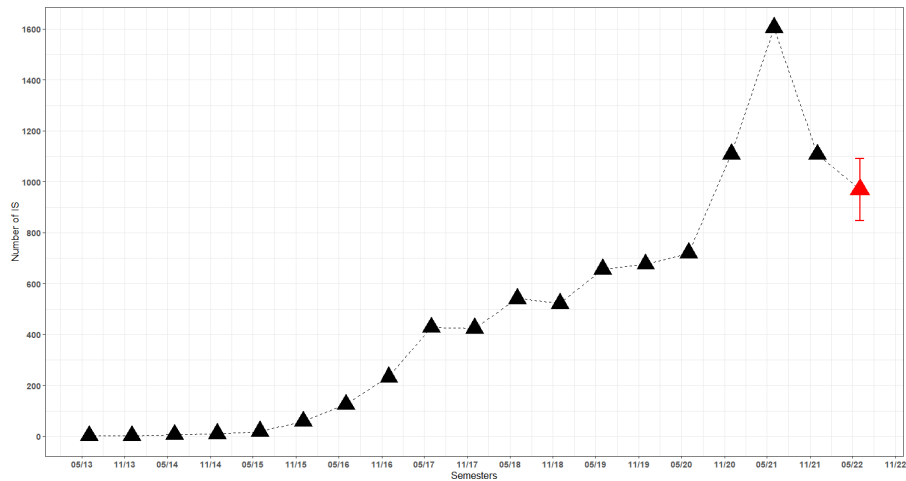


Figure C1.: Test performed by the optimal U-MIDAS model: in red the predicted values while the red bar represents the 95% confidence interval of the forecast

Appendix D. IS with human or/and technological capital (G2)

Table D1.: Path-steps EC for “Number of IS” with human or/and technological capital

path-steps w_i	EC
w_1	-
w_2	0.045
w_3	0.119
w_4	0.147
w_5	0.162
w_6	0.161
w_7	0.152
w_8	0.140
w_9	0.137
w_{10}	0.134
w_{10}	0.127

Table D2.: PCA for half-year frequency variables for IS with human or/and technological capital

Principal Component	PC1	PC2
Standard deviation	0.40	0.19
Proportion of Variance	0.81	0.18
Cumulative Proportion	0.88	1.00

Table D3.: PCA loadings of the variables with half-year frequency for IS with human or/and technological capital

Variable with h-y Frequency	PC1	PC2
<i>Percentage of IS in the North</i>	0.56	0.83
<i>Percentage of IS in the South</i>	-0.83	-0.56

Table D4.: PCA for quarterly frequency variables for the IS with human or/and technological capital

Principal Component	PC1	PC2	PC3	PC4	PC5
Standard deviation	13600	31.26	9.40	4.30	1.84
Proportion of Variance	1.00	0.00	0.00	0.00	0.00
Cumulative Proportion	1.00	1.00	1.00	1.00	1.00

Table D5.: PCA loadings for the variables with quarterly frequency for IS with human or/and technological capital

Variable with q frequency	PC1
<i>R&D</i>	1.16E-03
<i>Business value of services</i>	2.58E-04
<i>Telecom business value</i>	3.80E-06
<i>Real residential Property Prices</i>	-9.03E-05
<i>GDP</i>	1.00E+00

Table D6.: PCA for monthly frequency variables for IS with human or/and technological capital

Principal Component	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Standard deviation	7679.13	1.291E+03	5.63	3.79	1.76	0.8373	0.58	0.41	0.30
Proportion of Variance	0.97	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Proportion	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D7.: PCA loadings for the variables with monthly frequency for IS with human or/and technological capital

Variables with m frequency	PC1	PC2
<i>Building producer price indices</i>	4.4E-04	3.0E-04
<i>Exports</i>	6.5E-01	-7.6E-01
<i>Imports</i>	7.6E-01	6.5E-01
<i>Consumer price index of all items</i>	3.1E-04	1.8E-04
<i>Import price index</i>	5.1E-04	2.5E-03
<i>Industrial production index</i>	4.0E-04	-1.5E-03
<i>Retail-food sales value index</i>	3.7E-04	-3.0E-04
<i>Index wages</i>	2.8E-04	-7.1E-04
<i>Unemployment Rate</i>	-1.2E-04	1.0E-04

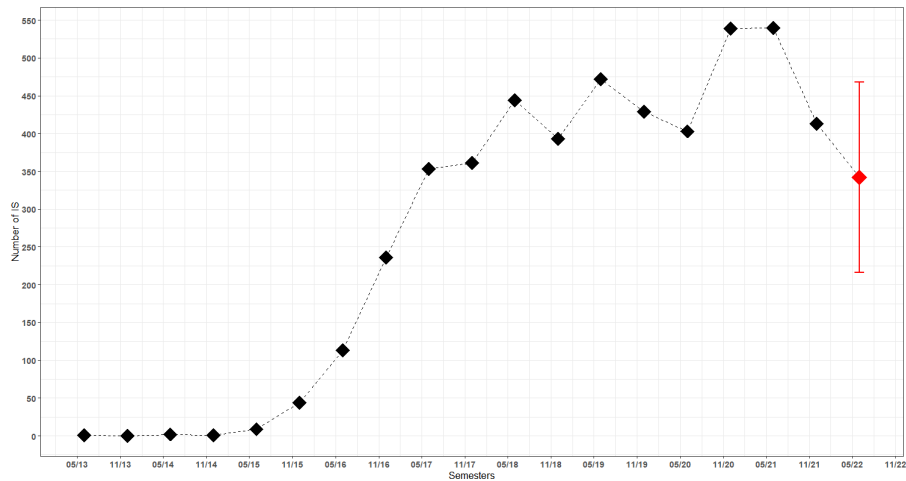


Figure D1.: Test performed by the optimal U-MIDAS model: in red the predicted values while the red bar represents the 95% confidence interval of the forecast