Revised backcasting procedure

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Content

1. Assets of interest

2. Data available: use table in ESA-2010 for all the economy World Input-Output Database (Wiod), and use table disaggregated by institutional sector (IT, CZ)

3. Revised method for backcasting:
   - Detection of Outliers in Wiod
   - Evaluation of 2 alternative methods
   - Combination of methods (with weights evaluation)

1. Assets estimated

Use table are the input for the estimation of:

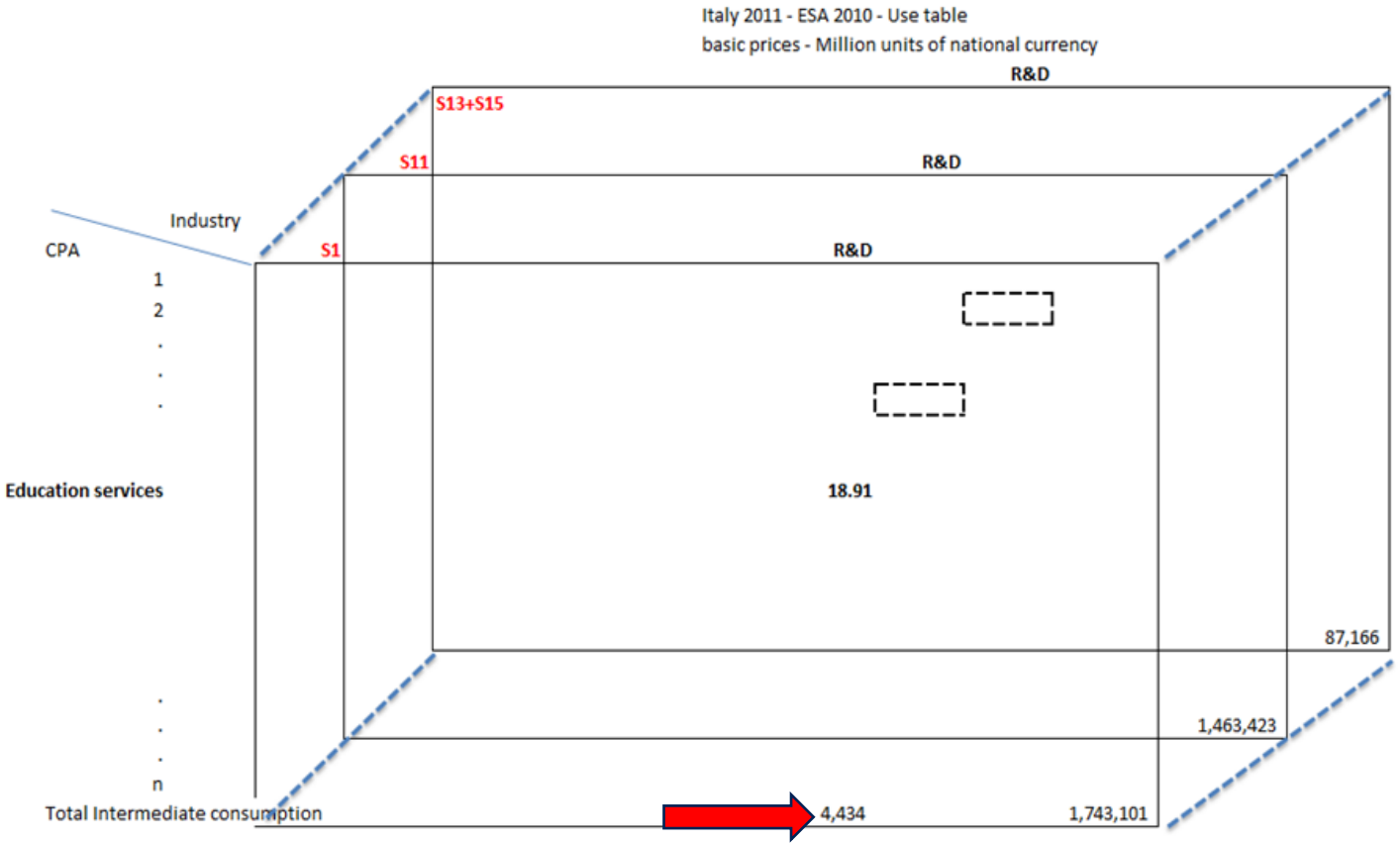
- Organisation capital (M702)
- Training (P85)
- Advertising (M73)
- Design (M71)

For R&D and software the estimation method starts from GFCF information set.

2. Data Available

- 2010-2011 use table ESA 2010, Nace 2
- 1995-2009 use table ESA 1995, Nace 1.1
- IT and CZ use table S1-S13, ESA 2010, Nace 2, 1995-2011, IT from 2000

Data Available: a graphical representation



What we need

Growth Rate between year t and year t-1						
	M72	O84	P85	Q86	Q87-Q88	R90-R92
Organisational Capital						
Advertising						
Design						
Training						
Total						

What we have: WIOD – Nace 1.1

		Growth Rate between year t and year t-1					
		Public_Admin	Education			Health_and_Social_Work	
		O84	M72	P85	R90-R92	Q87-Q88	Q86
Other services	Organisational Capital						
	Advertising						
	Design						
Training	Training						
	Total						

What we have:

Total intermediate consumption for industry – Wiiw method

		P2 - Intermediate consumption by Industry (Nace Rev 2)					
	TOTAL	M72	O	P	Q86	Q87_Q88	R90-R92
1995	107.524	153	3.584	2.272	1.991	1.899	523
1996	112.028	239	3.792	2.420	2.100	2.039	632
1997	116.585	209	3.786	2.408	2.202	2.103	656
1998	120.573	266	3.924	2.562	2.354	2.237	685
1999	128.446	327	4.264	2.845	2.503	2.454	713
2000	142.605	360	4.735	2.912	2.638	2.631	722
2001	152.718	461	4.988	3.124	2.910	2.927	761
2002	155.404	682	5.148	3.223	3.224	3.052	875
2003	155.319	569	5.137	3.262	3.364	3.143	951
2004	161.830	601	5.472	3.499	3.583	3.283	959
2005	180.831	681	6.020	3.553	3.939	3.437	992
2006	200.321	800	6.350	3.653	4.358	3.543	1.085
2007	217.036	942	5.874	3.673	4.795	3.972	1.105
2008	230.222	1.422	6.530	4.017	5.170	4.355	1.107
2009	203.621	1.244	7.068	4.441	5.427	4.524	1.185
2010	209.197	1.243	7.023	4.730	5.375	4.502	1.186
2011	224.268	1.365	6.588	4.809	5.424	4.283	1.257
2012	232.766	1.448	7.066	5.062	5.714	4.367	1.280
2013	234.358	1.627	6.885	5.105	5.815	4.345	1.241
2014	238.638	2.081	7.069	5.135			

3. Revised method for backcasting: WIOD

- Different economic classification: correspondence table for assets and industries

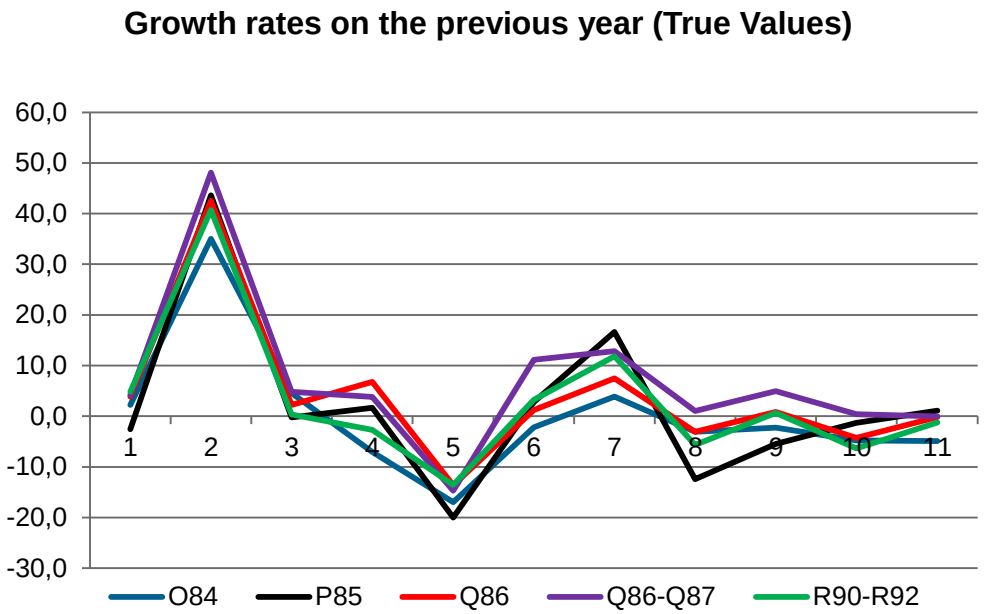
- Outlier in growth rates (1995-2010) for the reconstruction of WIOD use tables → correction method in two steps:
  - Growth rates smaller than -15% or bigger than 15% are considered outlier (empirical evaluation of threshold)
  - For each time series (industry, product and country) with less than 3 outlier, growth rates are corrected by the average on no-outliers
  - For records with more than 4 outlier we derive a donor from nearest time series

Intermediate consumption: hp on evolution by asset

- Dynamic of each asset is given by the dynamic of the total of the products but we have data for all the Spintan Industries
- Even if for Italy for example:

	Shares of training on the total of all product					
	M72	O84	P85	Q86	Q87-Q88	R90-R92
2000	2,0	3,5	4,3	0,7	1,5	0,7
2001	1,9	3,3	4,0	0,6	1,5	0,7
2002	2,5	4,4	5,5	0,9	2,0	0,9
2003	2,5	4,4	5,2	0,8	1,9	0,9
2004	2,5	4,0	5,1	0,8	1,8	0,8
2005	2,1	3,2	4,1	0,7	1,5	0,7
2006	2,1	3,3	4,2	0,6	1,5	0,7
2007	2,2	3,5	4,4	0,6	1,6	0,7
2008	2,0	3,2	4,1	0,6	1,5	0,7
2009	0,5	3,1	3,9	0,6	1,5	0,6
2010	0,4	2,9	3,7	0,5	1,4	0,5
2011	0,4	2,9	3,8	0,5	1,4	0,5

Training (P85) in Spintan Industries

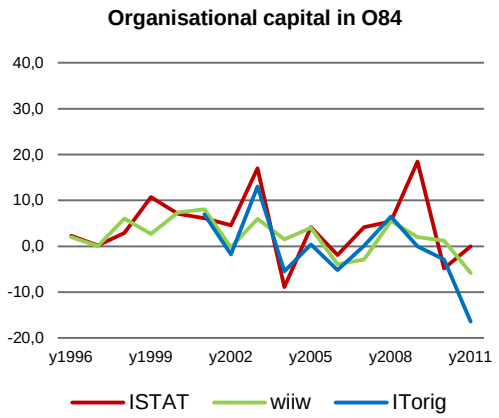


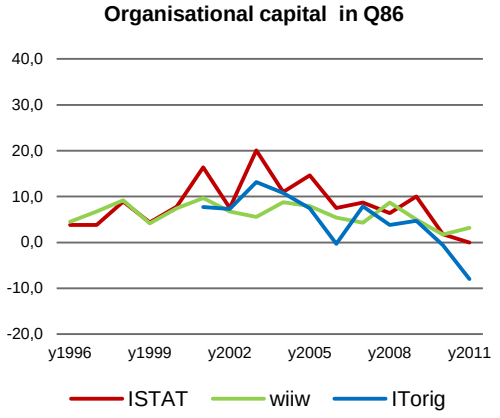
Comparison of the two approaches

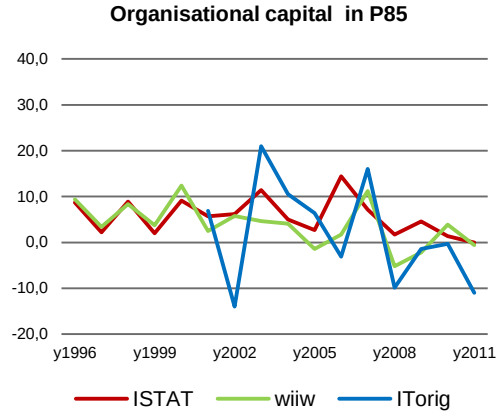
- Analysis for growth rates for the most important assets -> Fuzzy answer

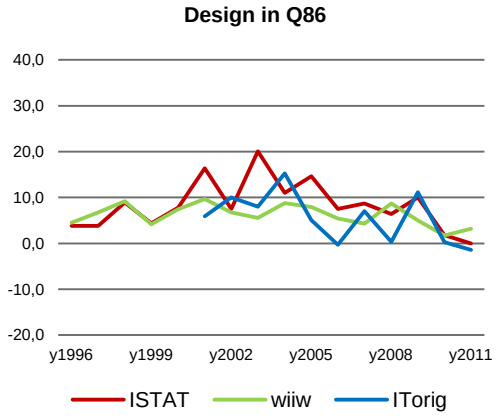
- square root of cumulated squared differences between original data and estimates divided by number of compared period

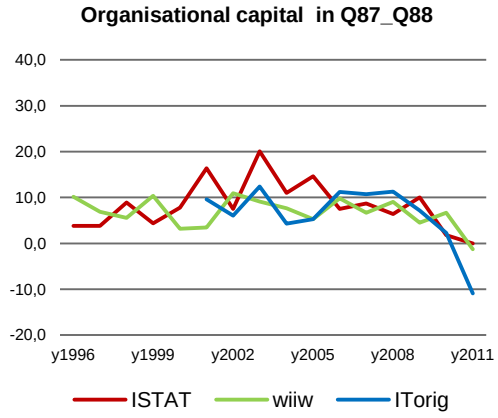
Analysis for growth rates

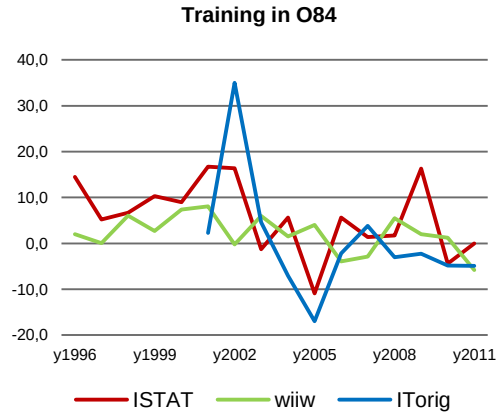












Performances of the 2 methods: square roots

COMPARISON BASED ON VALUES - Italy					
Rank S13 calc.	Asset	Product	Industry	Wiiw minus orig	Wiod minus orig
2	OrgCapital	M69_M70	Q86	480,9	463,2
1	OrgCapital	M69_M70	O84	103,5	253,1
4	Design	M71	Q86	262,8	233,6
3	OrgCapital	M69_M70	P85	282,7	229,4
7	Design	M71	P85	217,4	190,9
5	OrgCapital	M69_M70	Q87_Q88	152,4	151,0
8	Design	M71	Q87_Q88	90,9	89,2
6	Training	P85	O84	68,0	80,9
10	OrgCapital	M69_M70	R90_R92	43,1	64,1
11	Training	P85	P85	42,7	47,3
16	Design	M71	M72	29,9	39,3
17	OrgCapital	M69_M70	M72	17,7	33,9
9	Design	M71	O84	18,3	30,8
13	MarketResearch	M73	P85	35,1	30,5
19	MarketResearch	M73	R90_R92	21,5	23,0
14	Training	P85	Q87_Q88	8,3	13,1
12	Training	P85	Q86	7,9	10,1
15	MarketResearch	M73	Q86	10,7	9,1
20	Design	M71	R90_R92	7,9	8,7
22	Training	P85	R90_R92	8,9	7,5
18	MarketResearch	M73	O84	3,5	6,9
24	Training	P85	M72	6,3	6,4
21	MarketResearch	M73	Q87_Q88	4,7	4,6
23	MarketResearch	M73	M72	2,6	3,0

Results

- there is no unique method which is better approximating the original data set in terms of values

- for some SPINTAN industries Wiod is better, for some Wiiw

Mixed Approach

- both approaches have some pro's and con's

- Mixed approach using weights to combine the two methods

- Calculation of weights (evaluation on Italian data):
  a) Shrinkage
  b) Regression

Weights: Shrinkage

– Two regressions are estimated:

  – $y_t = \alpha_1 x_{t,Wiiw} + \epsilon_t$

  – $y_t = \alpha_2 x_{t,Wiod} + \epsilon_t$

a) y_t : growth rates for Italian Use Table

b) $x_{t,Wiiw}$: growth rates for total intermediate consumption

c) $x_{t,Wiod}$: growth rates for Wiod

– Residual variances are calculated for both the regression

– Smaller weight is given to the growth rate for which the variance of residuals is bigger

Weights: regression

$$y^{I}_{p,t} = \alpha_1 x^{I}_{t,Wiiw} + \alpha_2 x^{\dot{I}}_{\dot{p},t,Wiod} + \varepsilon_t$$

- $y^{I}_{p,t}$: growth rates for Italian Use Table by product p and industry I
- $x^{I}_{t,Wiiw}$: growth rates for total intermediate consumption by industry I
- $x^{\dot{I}}_{\dot{p},t,Wiod}$: growth rates for Wiod by industry $\dot{I}$ and product $\dot{p}$ where the correspondence table between industry and product is used

Regressions are carried out for each asset and each industry

Regression: an example

```
Call:
lm(formula = True_Des_R ~ Wiiw_R + Wiod_Others_Education - 1)

Residuals:
   Min     1Q Median     3Q    Max
-9.286 -1.984  0.362  2.451  5.140

Coefficients:
                      Estimate Std. Error t value Pr(>|t|)
Wiiw_R                  0.3720     0.2753   1.351    0.210
Wiod_Others_Education   0.2870     0.2565   1.119    0.292

Residual standard error: 4.271 on 9 degrees of freedom
Multiple R-squared:  0.5166,    Adjusted R-squared:  0.4091
F-statistic: 4.808 on 2 and 9 DF,  p-value: 0.03798
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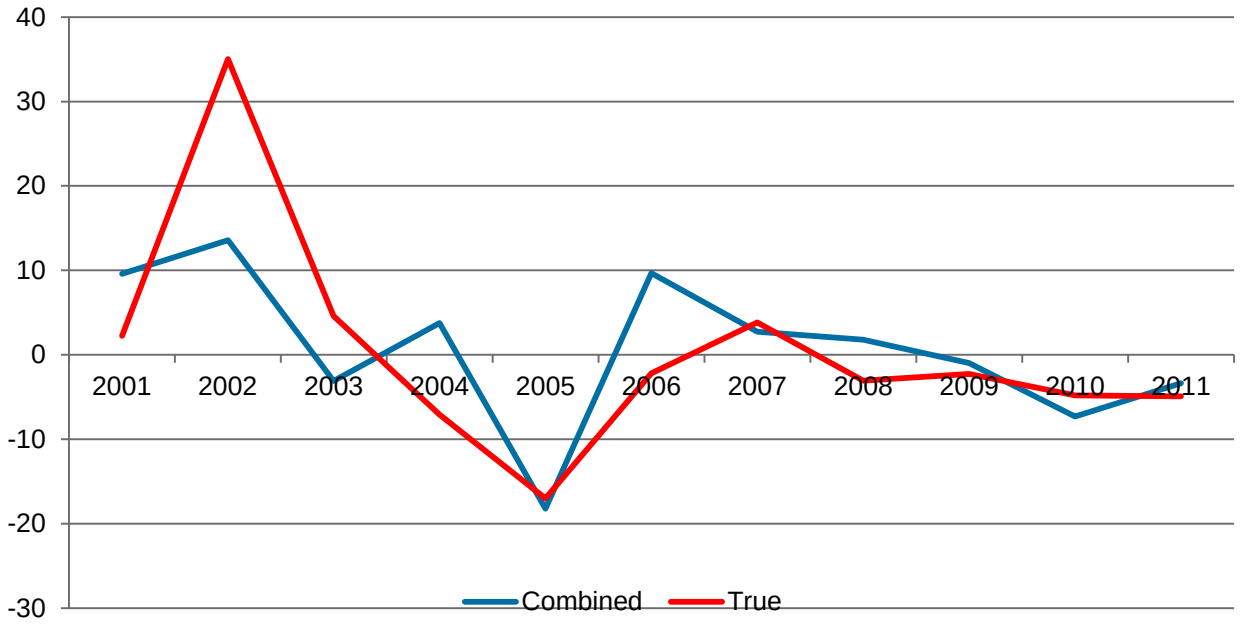
Weights: proposed method regression

– The estimates for parameters α_1 and α_2 are used for the calculation of the estimated growth rates $\hat{y}_{p,t}^{I}$ used as input for the backcasting

Results: Training (P85) in Public (O84)



Conclusion

- Revised backcasting is completed !

- The parameters for Italian Use Table are used for all other countries. With more countries data available a fine tuning will be feasible