Extracting Information from the SNB business survey:
Correlation and principal components analysis

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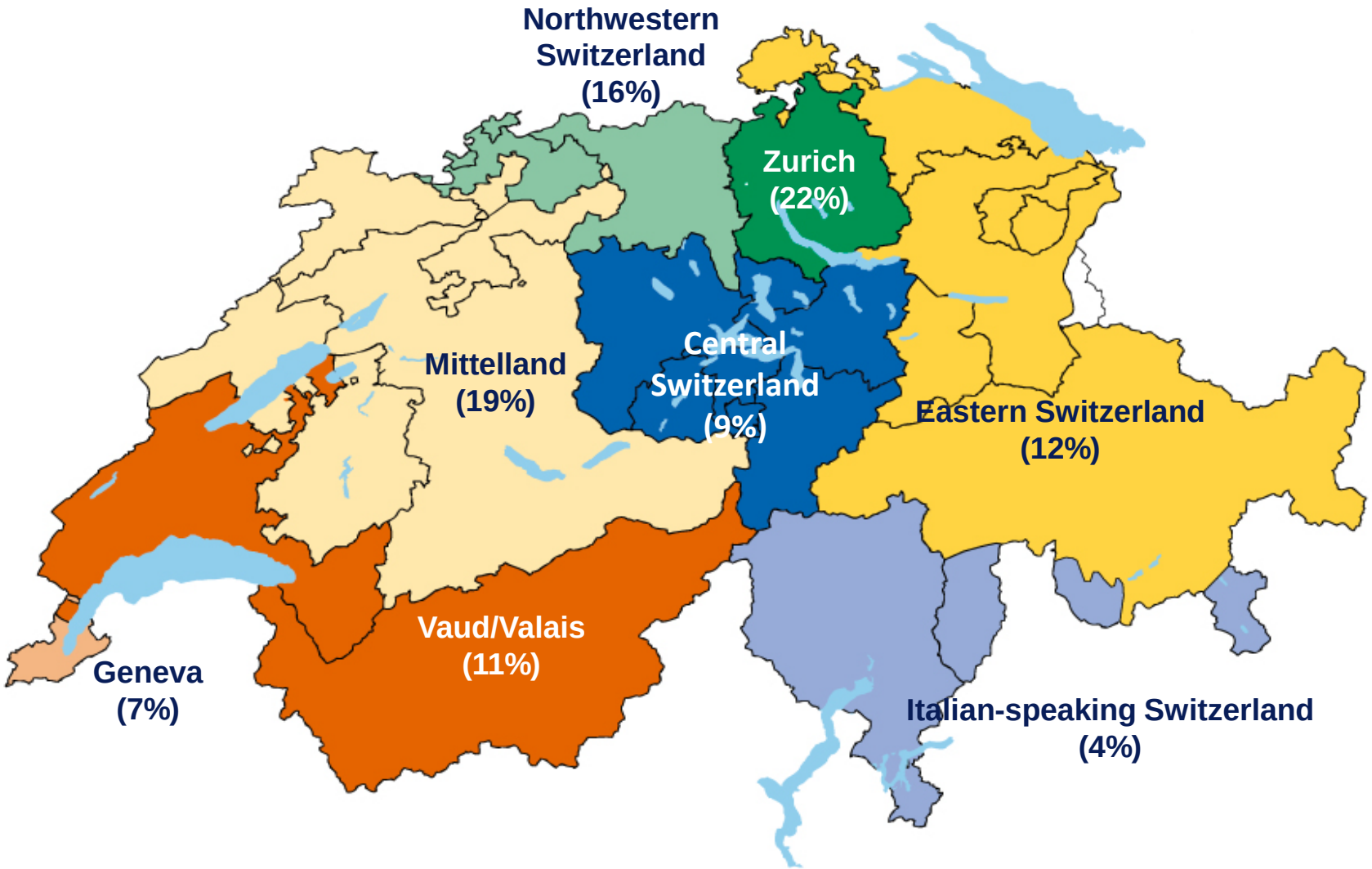
Agenda

- The SNB regional network and the business survey
- Correlation analysis
- Principal component analysis
- Conclusions

The SNB business survey

The SNB regional network: 8 regions, 8 delegates



Figures indicate regional GDP as a % of Swiss GDP

Methodology

- Approach progressively introduced from 2009 on
- 30 interviews in each region (240 observations)
- Sample replicates the structure of the various regional economies in terms of the number of employees per industry.
- Companies selected: a mix of fresh, recurrent and continuous participants, i.e. no random draw.
- 1:1 interviews on the firms' premises with CEO/CFO
- 60 to 90 minutes per interview
- Survey results are collected through an intranet platform
- Blue book prepared for the quarterly monetary and economic assessment
- Qualitative summary publication in the Quarterly Bulletin (→ Business cycle trends)

The questionnaire

- Standardized questionnaire leading to quantitative and qualitative evaluations
- Up to the delegates to fill out the questionnaire
- 18 questions, most of them multiple choice
- Multiple choice: 5 options, plus ‘not relevant’
- Questions on the past, the present, and the future
- Topics:

  - turnover, capacity utilization, inventories, margins
  - labor market, employment, salaries
  - purchase and sale prices, investment, general price developments/inflation

Correlation analysis

Methodology of evaluation of results

- Only small sample; preliminary results
- Graphical analysis
- Correlation analysis
- Question:
  → How can the questionnaire be optimized?
  → Which questions are “unique” and which could possibly be dropped?

Results: Correlation of answers (t-t)
Sample: q1/10 – q3/13

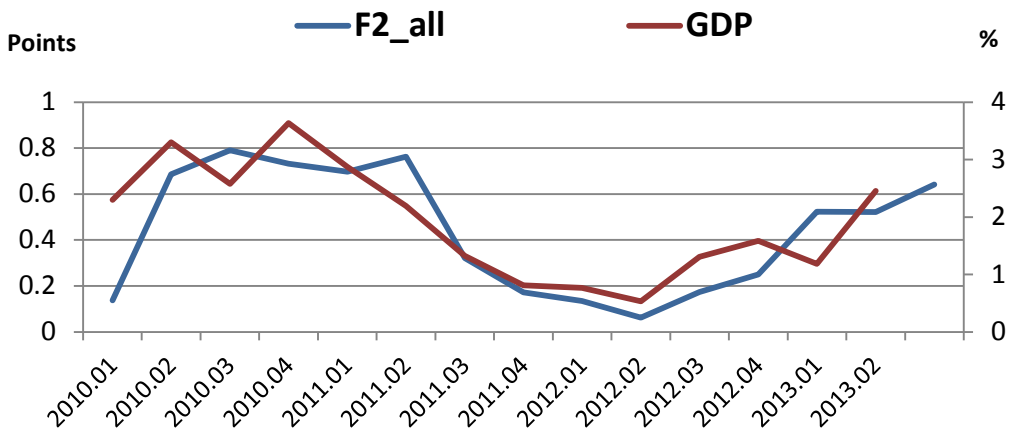
Scale of correlation assessment	
≥ 0.8	strong
0.8 ≥ 0.6	moderately strong
0.6 ≥ 0.4	moderate
0.4 ≥ 0.2	weak
< 0.2	insignificant

	Cap Util	Ex CapUtil	TO yoy	TO qoq	Invent	StLe Adeq	Recr Cond	Marg	Ex TO	Ex Empl	Ex PuPr	Ex SaPr	Ex GePrDev	Ex Infl	Ex InvEq	Ex InvCo
CapUtil	1.000	-0.099	0.383	0.061	-0.139	0.574	0.777	0.222	0.048	0.345	0.073	0.325	0.417	0.157	0.192	0.344
ExCapUtil		1.000	0.759	0.853	-0.557	0.595	-0.150	0.658	**0.947**	0.828	0.850	0.661	0.893	0.685	0.713	0.365
TOyoy			1.000	0.874	-0.650	0.840	0.119	0.668	0.771	**0.920**	0.715	0.827	0.564	0.696	0.752	0.496
TOqoq				1.000	-0.654	0.722	-0.167	0.687	0.848	0.875	0.737	0.755	0.625	0.711	0.710	0.415
Invent					1.000	-0.662	-0.193	-0.482	-0.643	-0.677	-0.662	-0.702	0.110	-0.710	-0.626	-0.561
StLeAdeq						1.000	0.410	0.475	0.659	0.869	0.671	0.718	0.829	0.805	0.646	0.509
ReCond							1.000	0.049	0.060	0.219	0.050	0.159	-0.311	0.197	0.205	0.323
Marg								1.000	0.723	0.737	0.637	0.673	0.643	0.271	0.584	0.063
ExTO									1.000	**0.906**	0.834	0.675	0.766	0.702	0.793	0.360
ExEmpl										1.000	0.808	0.798	0.676	0.749	0.795	0.420
ExPuPr											1.000	0.832	0.583	0.760	0.567	0.374
ExSaPr												1.000	0.134	0.642	0.597	0.489
ExGePrDev													1.000	**0.933**	0.557	-0.587
ExInfl														1.000	0.676	0.682
ExInvEq															1.000	0.629
ExInvCo																1.000
AvCorrel	0.245	0.533	**0.582**	0.537	-0.520	**0.577**	0.117	0.441	0.563	**0.618**	0.522	0.505	0.455	0.531	0.519	0.288

Correlation of answers with economic variables Sample: q1/10 – q3/13

Correlation between past turnover at time t and the real GDP yoy (GDP)

GDP (t-4)	-0.253	insignificant
GDP (t-3)	0.119	insignificant
GDP (t-2)	0.546	moderate
GDP (t-1)	0.877	strong
GDP (t)	0.785	moderately strong
GDP (t+1)	0.539	moderate
GDP (t+2)	0.317	weak
GDP (t+3)	-0.166	insignificant
GDP (t+4)	-0.594	insignificant



Correlation of answers with economic variables Sample: q1/10 – q3/13

Assessing the Correlation Results

Survey variable	Economic variable	Maximum correlation (lag)	Second highest correl.
Current business activity			
Current turnover yoy	Change of real business GDP	strong: t-1	**moderately strong: t**
Current turnover qoq	Change of real business GDP	moderately strong: t-1	**moderate: t,** t-2
Current margins	Total business investment	**moderate: t+1**	**weak: t+2, t**
Outlook for business actitivity			
Expected turnover	Change in real (business) GDP	**moderately strong: t+1, t,** t-1	**moderate: t+2**
Expected capacity/infrastructure util.	Industrial capacity utilization rate	**moderately strong: t+2, t+1, t,** t-1	**moderate: t+4**
Expected equipment investment	Business investment in equipment	**moderately strong: t+1, t+2**	**moderate: t**
Expected construction investment	Business investment in buildings	**moderate: t+1**, t-1	**weak: t,** t-2
Expected employment	Inflows into unemployment	**moderately strong: t+2, t+1**	**moderate: t, t+3**
Pressures on production capacity			
Number of staff (labour shortages)	Output gap	**strong: t**	**moderately strong: t+1,** t-1
Capacity/infrastructure utilisation	Industrial capacity utilization rate	strong: t-1, t-2	moderatly strong: t-3
Outlook for prices, inflation			
Expected input prices	GDP deflator	**moderately strong: t**	**moderate: t+1**
Expected output prices	Total CPI	**moderately strong: t+1**	**moderate: t+2, t**, t-1
Inflation expectations	Total CPI	strong: t-1	**moderately strong: t, t+1**
Labor market conditions			
Recruitment conditions	Unemployment	**strong: t+2, t+1**	**moderately strong: t**

Principal component analysis (PCA)

Goals

- Improve our knowledge of the data: what are the dimensions covered by the questionnaire?
- How do these dimensions correlate with macro-economic variables?
- How do compare aggregated indicators with single items?

→ Three step analysis:
(1) data reduction by means of PCA,
(2) correlation analysis and
(3) early assessment of PCA indices vs. single item.

Methodology

- PCA enables to extract common movements from various SNB business survey indicators
- PCA entails methodological choices:
  - Number of selected factors: Kaiser criteria (eigenvalues>1)
  - Rotation criteria: correlation between factors allowed
  - Treatment of missing variables: imputation with modal answers by sector and quarters
- We use information collected over 14 quarters (q2/2010 - q3/2013), 3129 interviews, 13 items
- Robustness checks:
  - Methodological choices: rotation, imputation.
  - Stability of the factors over time or across regions

Results: rotated factors

Rotated factor loadings

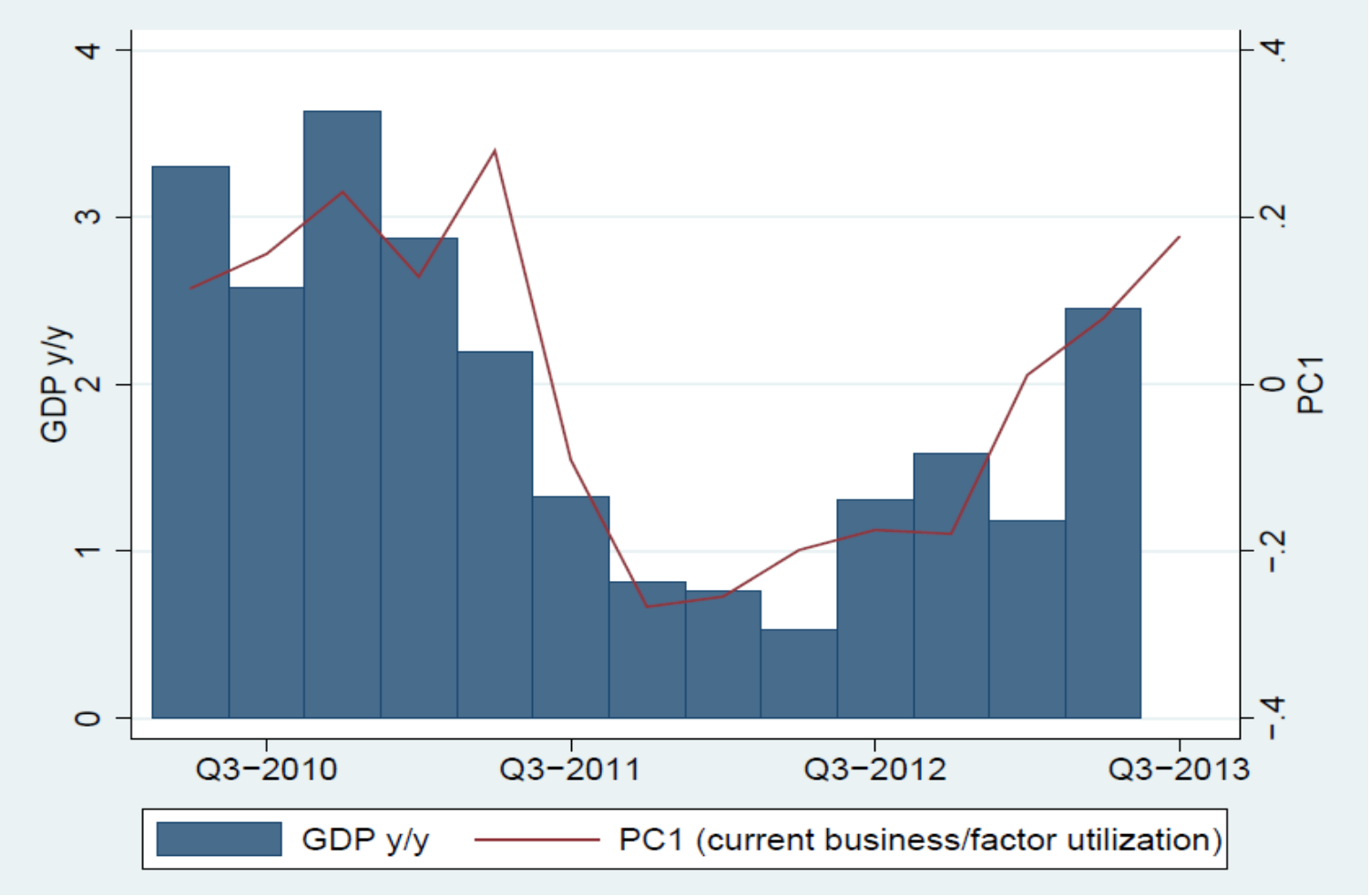
Variables	PC1	PC2	PC3	PC4	Uniqueness
Current turnover y/y	0.7815				0.3537
Current turnover q/q	0.6327				0.4079
Labor shortages	0.6078				0.3578
Recruitment conditions				0.6109	0.6248
Margins					0.8081
Expected turnover		0.7679			0.3005
Expected employment					0.3953
Expected input prices			0.7612		0.4133
Expected output prices			0.7462		0.4038
Expected equipment investment				0.5156	0.7151
Capacity utilization	0.7641				0.3569
Expected capacity utilization		0.8785			0.2640
Inflation expectations					0.7037
Proportion	0.2343	0.1155	0.1004	0.0802	.
Cumulative	0.2343	0.3498	0.4502	0.5304	.

Notes: blanks represent abs(loading)<.5; Number of observations: 3129

Results: comments

- The following dimensions consistently emerged:
  1. Current business conditions
  2. Use of factors of production (labor and capital)
  3. Perspective
  4. Evolution of input/output price
- The factors:
  - are consistent between periods under scrutiny (year, exchange rate regime), some discrepancies between regions
  - do not depend on the rotation method

Indices and macro-economic variables



Indices: correlations with macro-economic variables

Scale of correlation assessment	
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< 0.2	insignificant

	PC1: current business/factor utilization		PC2: Perspectives		PC3: Input/output prices		PC4: Recruiting/investment	
GDP y/y	**0.8715**	**0.8469**	**0.7697**	**0.7211**	**0.8624**	**0.8110**	0.2792	0.2566
GDP y/y (+1)	**0.7125**		**0.8047**		**0.7072**		-0.0102	
GDP y/y (+2)	0.3445		0.6621		0.4006		-0.4509	
Output gap (HP)	**0.8486**	**0.7429**	0.5277	0.4714	**0.7625**	**0.7517**	**0.8021**	**0.8255**
Output gap (%)	**0.9240**	**0.8763**	0.6961	0.6649	**0.8660**	**0.8600**	0.6294	0.6400
GDP q/q	0.4721	0.4786	0.5078	0.5111	0.5300	0.4994	-0.2068	-0.2459
GDP q/q (+1)	-0.0613		0.2575		0.0223		-0.5631	
GDP q/q (+2)	-0.1108		0.0983		-0.1516		-0.4913	
Equ. Invst y/y	**0.7265**	0.5044	0.6270	0.4256	0.6942	0.5779	0.5651	0.5942
Equ. Invst y/y (+1)	0.6924		0.6337		0.5933		0.4014	
Equ. Invst y/y (+2)	0.5896		0.6594		0.5924		0.1524	
Demand	**0.7696**	0.6763	**0.8033**	**0.7066**	**0.7914**	**0.7515**	0.1091	
Inflows unemployment	-0.6695	-0.5111	-0.3527	-0.3141	-0.6260	-0.6098	**-0.9087**	**-0.8943**
Inflows unemployment (+1)	**-0.7331**		-0.5535		**-0.7427**		**-0.7391**	
Inflows unemployment (+2)	-0.6530		-0.5876		-0.6641		-0.4436	
Hours worked q/q	**0.9193**	**0.8172**	0.5918	0.5503	**0.8743**	**0.8742**	0.5403	0.5864
Hours worked q/q (+1)	**0.8295**		**0.9034**		**0.8139**		0.3010	
Hours worked q/q (+2)	0.6272		**0.8030**		**0.6628**		-0.0463	
Deflator (change)	0.5097	0.5025	**0.7378**	**0.7378**	0.6722	0.6675	0.2203	0.216
N	11	13	11	13	11	13	11	13

Indices or single-item? Explaining GDP growth (y/y)

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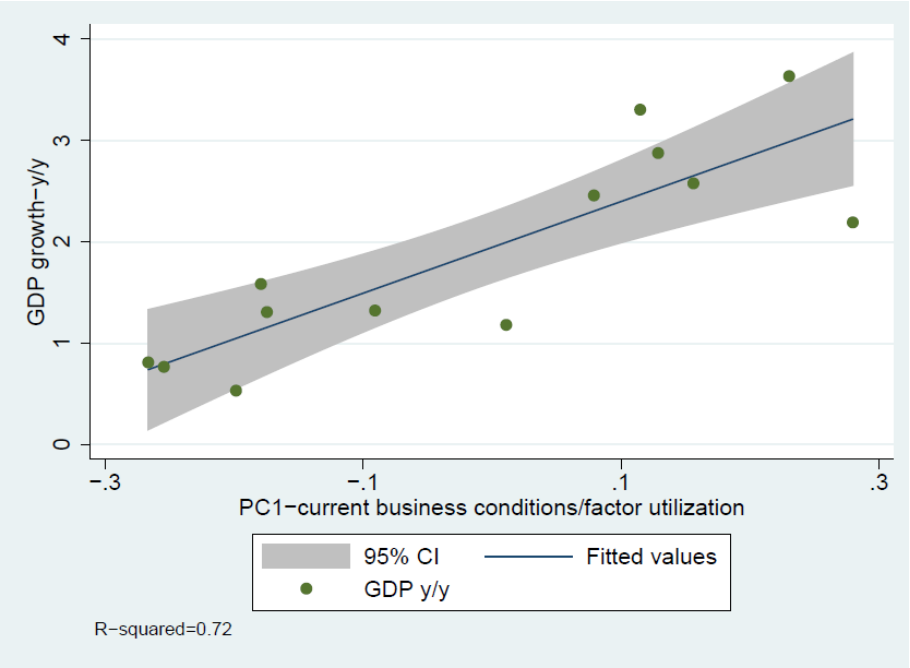
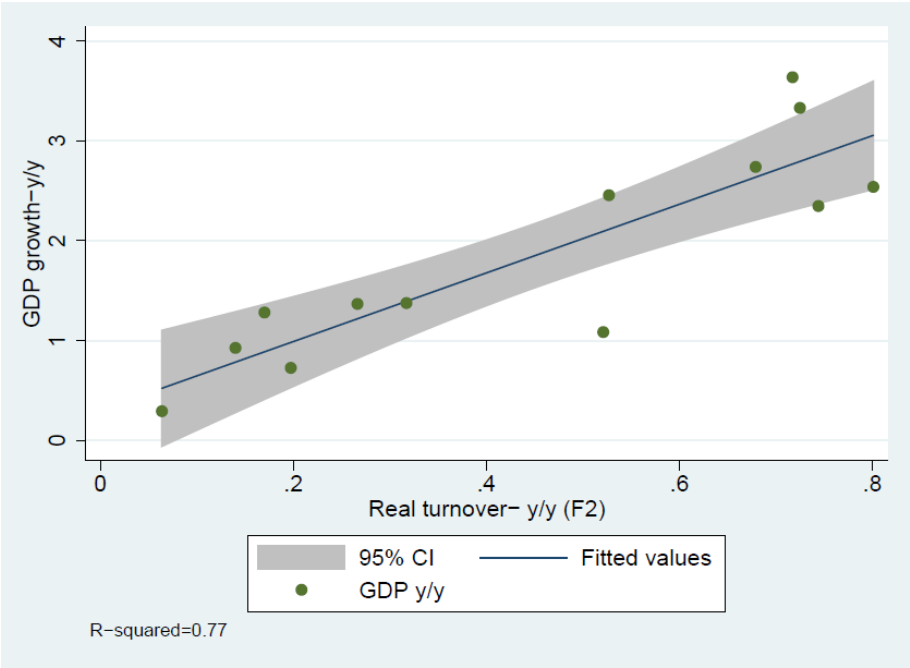


Single item



Indices or single-item? Signal of future activity

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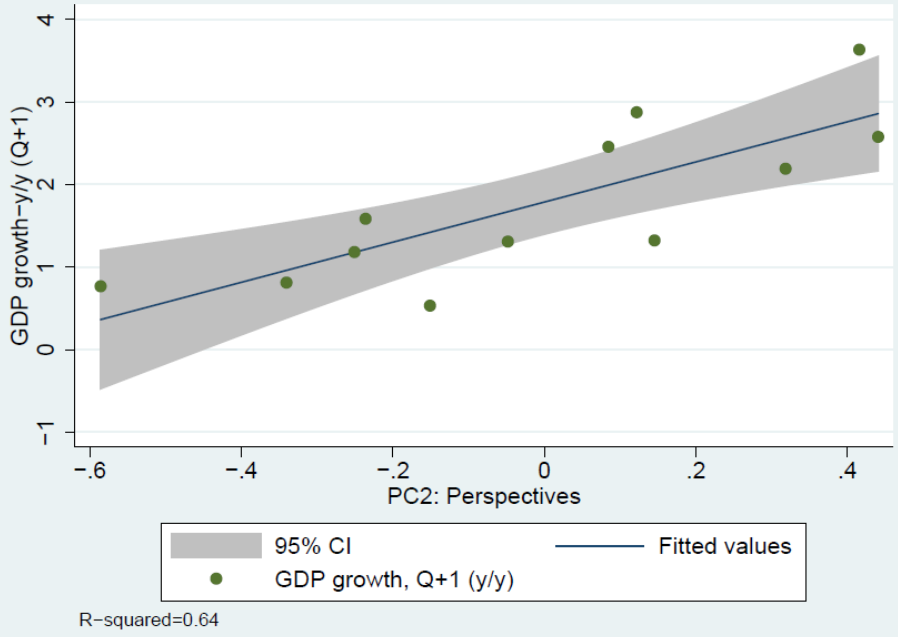

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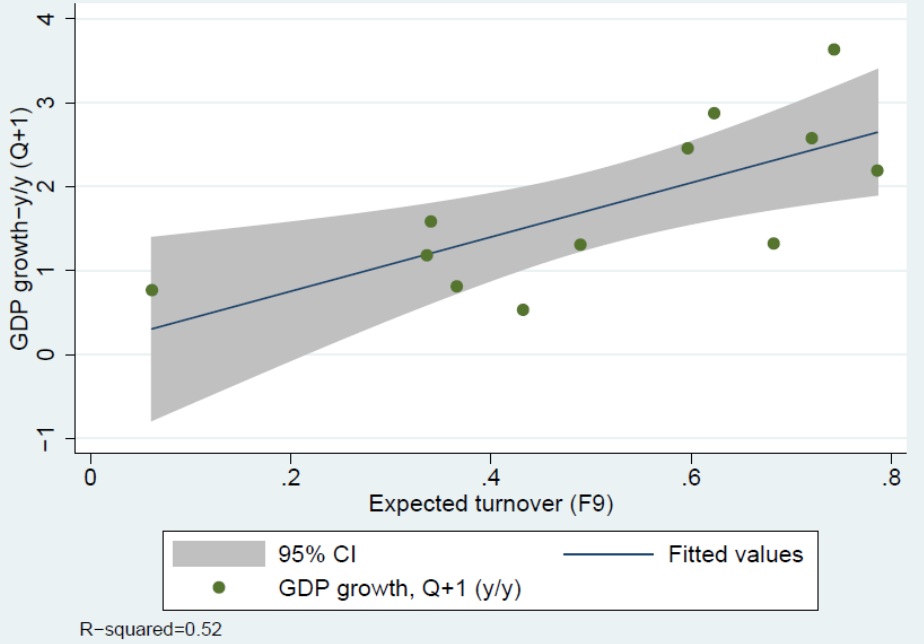

Conclusions and outlook

- Survey provides
  - an informative barometer of the Swiss economy and leading signals of future activity
  - information about production constraints, labour shortages, and inflation expectations
  - qualitative information on several issues that are on managers' minds
- Preliminary analysis of correlations and principal components is promising
- Important to update analysis as the number of observations grows
- Value goes well beyond numerical data captured in the survey
- Interview format allows for broader understanding of current business perceptions

