Presentation of the seminar paper:

Investigation of panel data featuring different characteristics that affect football results in the German Football League (1965-1990):

Controlling for other factors, are there significant effects of changes inside the team which make it easier to influence success?

PhD-Course „Econometric Methods of Panel Data“
Hosted by Prof. Robert Kunst
University of Vienna
June 10th, 2009

Motivation

1. State of work:
   - In progress, together with Berno Büchel (University of Bielefeld)
2. Under investigation:
   - Success in business/poltics tricky to measure, while outcome in sports is somehow one-dimensional and „easy trackable“
   - Accessable: success → change

     Changes are negatively influenced by degree of success
   - Rather evident: success → success

     Higher self-esteem (presumably dominating) vs. „pressure leads to higher effort“
   - Not evident: change → success

     Coach‘s trade-off: Learning vs. pressure
3. Basic approach:
   - Success (goal difference) as explained variable
   - Nr. of changes explaining variable (along with different control variables)
   - Distinction between three base cases (change after a victory, after a draw, and after a defeat)

Used Data

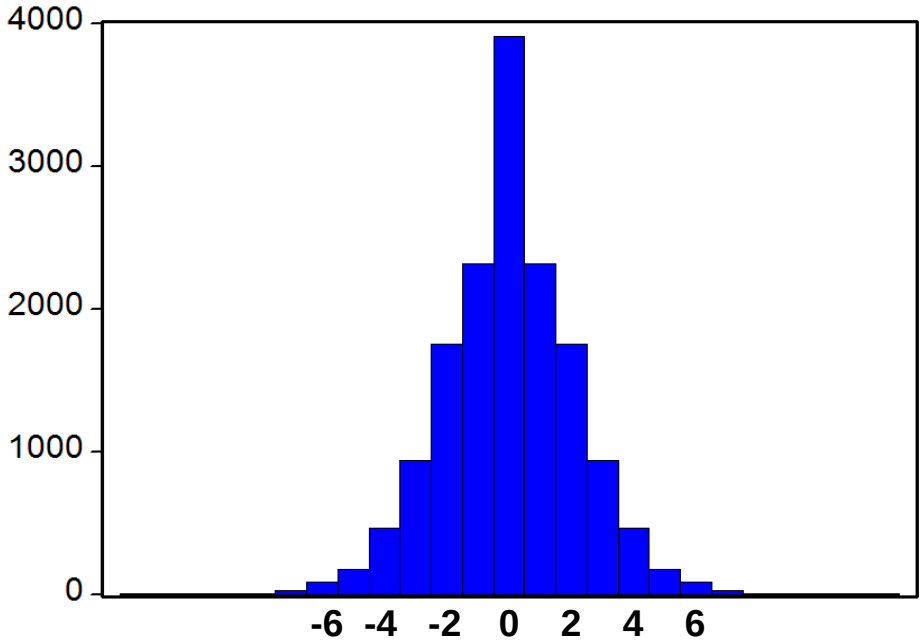
1. Data provider:

   IMPIRE AG (Germany)

2. Data:
   - Football results in the first German football league
   - 1965-1990: 26 seasons*34 games, 39 clubs (15912 unbalanced observations)
   - Covering different aspects as: Involved clubs, hosting club, result, clubs‘ chart positions, number of player exchanges compared to last game

3. Data modifications:
   - First game of each season removed
   - Results of first game still stored and used as lagged values in second game to prevent additional loss of observations

Descriptive Statistics of Dependent Variable



Series: GODI	
Cross-sections: 39	
Time points: 858	
Observations (Unbalanced): 15444	
Mean	-0.000194
Median	0.000000
Maximum	12.00000
Minimum	-12.00000
Std. Dev.	2.134034
Skewness	9.32e-05
Kurtosis	3.916738


RHEINSTADION DUESSELDORF
BOR.M.-GLADBACH - BOR.DORTMUND
12:0
1:0 HEYNCKES 11
2:0 HEYNCKES 11
3:0 NIELS N 5
4:0 DEL'HAYE 9
5:0 HEYNCKES 11
6:0 WIMMER 8
7:0 HEYNCKES 11
8:0 NIELSEN 5
9:0 DEL'HAYE 9
10:0 HEYNCKES 11
11:0 LIENEN 13
12:0 KULIK

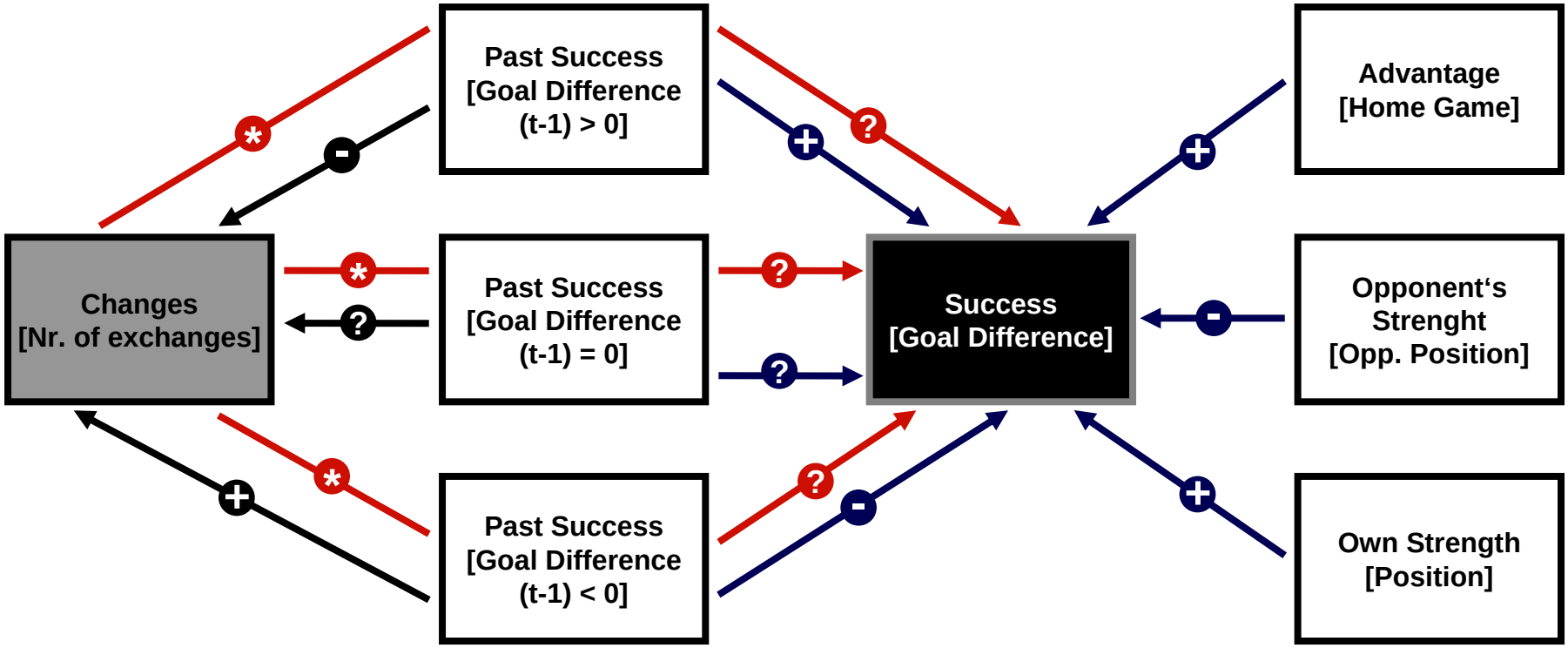
Descriptive Statistics of Dependent Variable

CLUB	Mean	Max	Min.	Std. Dev.	Obs.
1860 München	-0.030303	8.000000	-5.000000	2.029963	264
Alemannia Aachen	-0.595960	4.000000	-6.000000	2.161439	99
Bayern München	0.984848	10.00000	-7.000000	2.236538	858
Arminia Bielefeld	-0.496212	5.000000	-10.00000	2.022681	264
VfL Bochum	-0.175758	6.000000	-6.000000	1.864781	660
Borussia Neunkirchen	-1.651515	2.000000	-10.00000	2.471327	66
Eintracht Braunschweig	-0.171717	6.000000	-10.00000	2.027004	594
Werder Bremen	0.225455	7.000000	-7.000000	2.104106	825
BW 90 Berlin	-1.121212	3.000000	-7.000000	1.932576	33
Darmstadt 98	-1.075758	3.000000	-6.000000	1.986962	66
Borussia Dortmund	0.052342	10.00000	-12.00000	2.229585	726
MSV Duisburg	-0.210339	9.000000	-7.000000	1.981693	561
FC Homburg	-0.919192	3.000000	-6.000000	1.888076	99
Fortuna Düsseldorf	-0.223285	7.000000	-7.000000	2.093936	627
Fortuna Köln	-0.939394	3.000000	-5.000000	2.192878	33
Eintracht Frankfurt	0.158508	8.000000	-7.000000	2.098075	858
Hamburger SV	0.413753	8.000000	-7.000000	2.117912	858
Hannover 96	-0.354312	6.000000	-7.000000	1.944405	429
Hertha BSC Berlin	-0.136364	8.000000	-6.000000	1.970723	462
Karlsruher SC	-0.587413	5.000000	-8.000000	2.067761	429
All	**-0.000194**	**12.00000**	**-12.00000**	**2.134034**	**15444**

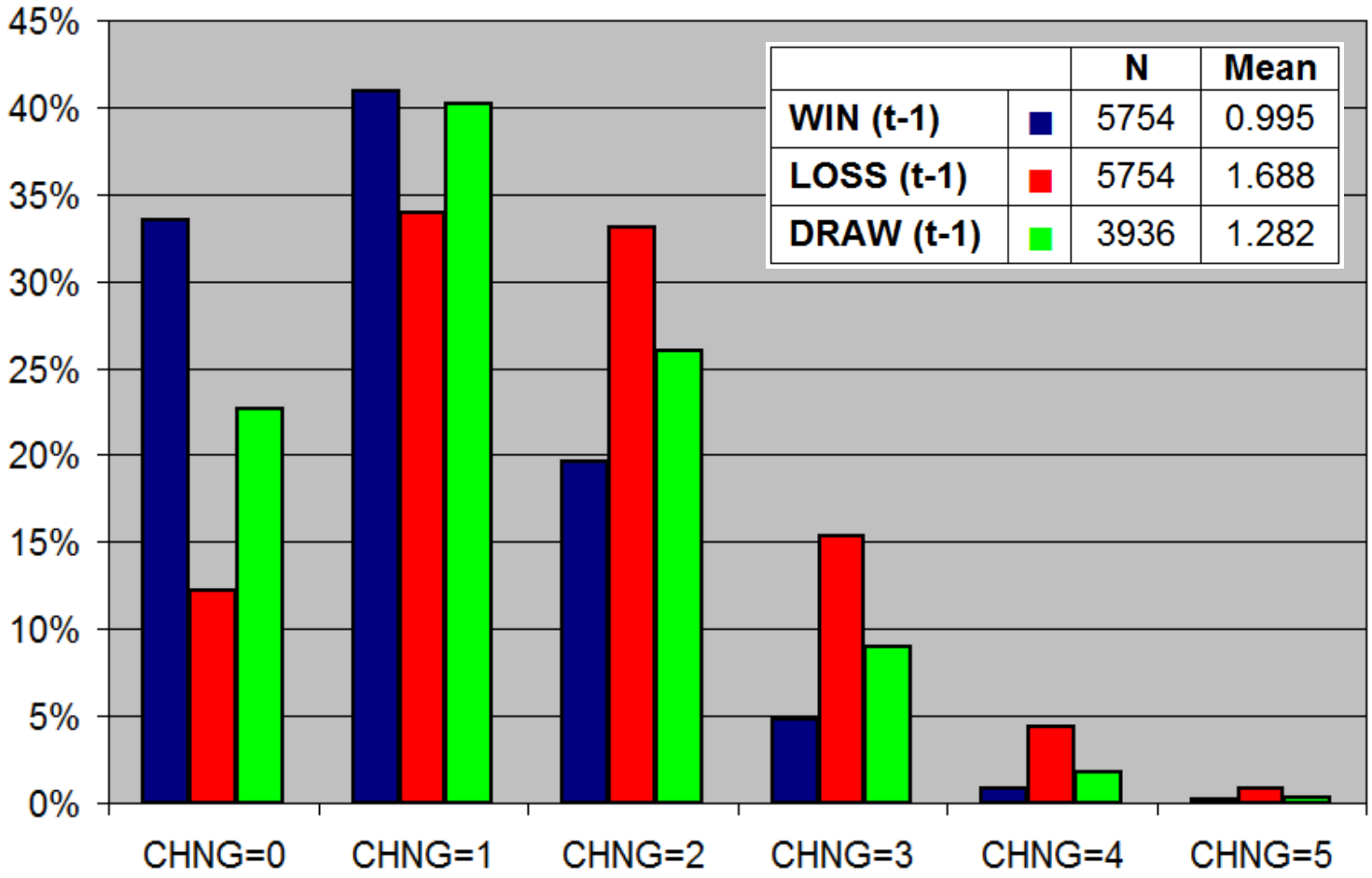
Descriptive Statistics of Dependent Variable

CLUB	Mean	Max	Min.	Std. Dev.	Obs.
Bayer/KFC Uerdingen	-0.371901	5.000000	-6.000000	1.996401	363
1.FC Kaiserslautern	0.037296	7.000000	-7.000000	2.120855	858
1.FC Köln	0.459207	8.000000	-7.000000	2.086539	858
Bayer Leverkusen	-0.080808	5.000000	-5.000000	1.787024	396
Waldhof Mannheim	-0.324675	5.000000	-6.000000	1.898110	231
Bor. Mönchengladbach	0.567599	12.00000	-7.000000	2.237523	858
1.FC Nürnberg	-0.260606	5.000000	-7.000000	1.974217	495
RW Oberhausen	-0.734848	7.000000	-7.000000	2.202912	132
Offenbacher Kickers	-0.519481	5.000000	-9.000000	2.200457	231
Rot-Weiss Essen	-0.584416	4.000000	-8.000000	2.076896	231
1.FC Saarbrücken	-0.676768	5.000000	-6.000000	1.878060	99
Schalke 04	-0.132756	7.000000	-11.00000	2.167744	693
FC. St. Pauli	-0.606061	4.000000	-7.000000	1.780975	132
VfB Stuttgart	0.308081	7.000000	-6.000000	2.192629	792
Stuttgarter Kickers	-0.787879	3.000000	-6.000000	2.341975	33
Tasmania Berlin	-2.878788	1.000000	-9.000000	2.117746	33
TeBe Berlin	-1.272727	4.000000	-9.000000	2.256924	66
Wattenscheid 09	-0.333333	3.000000	-7.000000	1.963203	33
Wuppertaler SV	-0.626263	5.000000	-6.000000	2.112093	99
All	**-0.000194**	**12.00000**	**-12.00000**	**2.134034**	**15444**

Estimated Relations and Expected Signs



Impact of Success on Number of Exchanges



Pooled OLS

1. Introducing Remarks:
   - Would mean that there are no individual differences between clubs and no common effects over time
   - A priori: Neglecting presumable individual effects will result in omission bias
2. Theoretical Model:

$$y_{it} = \alpha + \beta' X_{it} + \nu_{it}$$

3. Estimated Model:

$$GODI_{it} = C + C(2)*GODI_{i,t-1} + C(3)*CHNG_{it} + C(4)*CHNG_{it}*WIN_{i,t-1} + C(5)*CHNG*LOSS_{i,t-1} + C(6)*POS_{it} + C(7)*POSO_{it} + C(8)*HOME_{it} + \nu_{it}$$

Pooled OLS

4. Estimation output:

Dependent Variable: GODI
Method: Panel Least Squares (Pooled OLS)
Sample (T): 1 858 Cross-sections included (N): 39
Total panel (unbalanced) observations: 15444

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.043662	0.010506	4.155980	0.0000
CHNG	-0.034848	0.022151	-1.573197	0.1157
WIN(-1)*CHNG	-0.006724	0.028029	-0.239884	0.8104
LOSS(-1)*CHNG	0.026385	0.024032	1.097902	0.2723
POS	-0.066386	0.003139	-21.15167	0.0000
POSO	0.072059	0.002923	24.64980	0.0000
HOME	1.825248	0.031971	57.09067	0.0000
C	-0.934452	0.051748	-18.05787	0.0000

R-squared	0.222831	Mean dependent var	-0.000194
Adjusted R-squared	0.222479	S.D. dependent var	2.134034
S.E. of regression	1.881731	Akaike info criterion	4.102779
Sum squared resid	54657.51	Schwarz criterion	4.106739
Log likelihood	-31673.66	F-statistic	632.2622
Durbin-Watson stat	1.994927	Prob(F-statistic)	0.000000

Pooled OLS

5. Comments:

- Negative significant intercept
- Significant controlling variables ($GODI_{t-1}$, POS, POSO, HOME)
- Effects of CHNG turn out to be unclear

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.043662	0.010506	4.155980	0.0000
CHNG	-0.034848	0.022151	-1.573197	0.1157
WIN(-1)*CHNG	-0.006724	0.028029	-0.239884	0.8104
LOSS(-1)*CHNG	0.026385	0.024032	1.097902	0.2723
POS	-0.066386	0.003139	-21.15167	0.0000
POSO	0.072059	0.002923	24.64980	0.0000
HOME	1.825248	0.031971	57.09067	0.0000
C	-0.934452	0.051748	-18.05787	0.0000

Fixed Effects (One-Way)

1. Introducing remarks:
   - Accounts for unobserved differences between clubs (individual effects) but neglects common effects over time
   - A priori: Individual effects „make sense“, rather than time-effects
2. Theoretical model:

$$y_{it} = \alpha + \beta' X_{it} + \mu_i + \nu_{it}$$

3. Estimated model:

$$\begin{aligned} GODI_{it} = {} & [C] + C(2) * GODI_{i,t-1} + C(3) * CHNG_{it} + C(4) * CHNG_{it} * WIN_{i,t-1} \\ & + C(5) * CHNG * LOSS_{i,t-1} + C(6) * POS_{it} + C(7) * POSO_{it} + C(8) * HOME_{it} \\ & + \mu_i + \nu_{it} \end{aligned}$$

Fixed Effects (One-Way)

4. Estimation output:

Dependent Variable: GODI
Method: Panel Least Squares (LSDV)
Sample: 1 858 Cross-section included: 39
Total panel (unbalanced) observations: 15444

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.030453	0.010413	2.924661	0.0035
CHNG	-0.041622	0.022010	-1.891091	0.0586
WIN(-1)*CHNG	-0.000950	0.027739	-0.034261	0.9727
LOSS(-1)*CHNG	0.018366	0.023817	0.771155	0.4406
POS	-0.033290	0.003592	-9.268473	0.0000
POSO	0.071674	0.002889	24.80911	0.0000
HOME	1.794975	0.031622	56.76402	0.0000
C	-1.217280	0.053496	-22.75442	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.243415	Mean dependent var	-0.000194
Adjusted R-squared	0.241203	S.D. dependent var	2.134034
S.E. of regression	1.858934	Akaike info criterion	4.080858
Sum squared resid	53209.90	Schwarz criterion	4.103629
Log likelihood	-31466.38	F-statistic	110.0881
Durbin-Watson stat	1.997299	Prob(F-statistic)	0.000000

Fixed Effects (One-Way)

5. Comments:
   - Negative intercept (In this case of secondary relevance due to estimation procedure chosen by software)
   - Significant controlling variables ($GODI_{t-1}$, POS, POSO, HOME)
   - Effects of CHNG again unclear
   - Robust covariance matrix estimation procedures (Arellano [1987] and Beck/Katz [1995]) lead to analog results
   - Large T (=858) and small autoregressive coefficient (0.03) should lead to neglectable Nickell (1981) bias: Dynamics sufficiently captured

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.030453	0.010413	2.924661	0.0035
CHNG	-0.041622	0.022010	-1.891091	0.0586
WIN(-1)*CHNG	-0.000950	0.027739	-0.034261	0.9727
LOSS(-1)*CHNG	0.018366	0.023817	0.771155	0.4406
POS	-0.033290	0.003592	-9.268473	0.0000
POSO	0.071674	0.002889	24.80911	0.0000
HOME	1.794975	0.031622	56.76402	0.0000
C	-1.217280	0.053496	-22.75442	0.0000

Fixed Effects (Two-Way)

1. Introducing remarks:
   - Two significant error components would indicate that there are differences between the clubs (individual effects) and also common effects over time
   - A priori: Individual effects are easy imaginable while time effects are implausible
2. Theoretical Model:

$$y_{it} = \alpha + \beta' X_{it} + \mu_i + \lambda_t + \nu_{it}$$

3. Estimated Model:

$$GODI_{it} = [C] + C(2) * GODI_{i,t-1} + C(3) * CHNG_{it} + C(4) * CHNG_{it} * WIN_{i,t-1} + C(5) * CHNG * LOSS_{i,t-1} + C(6) * POS_{it} + C(7) * POSO_{it} + C(8) * HOME_{it} + \mu_i + \lambda_t + \nu_{it}$$

Fixed Effects (Two-Way)

4. Estimation output:

Dependent Variable: GODI
Method: Panel Least Squares (LSDV)
Sample: 1 858 Cross-sections included: 39
Total panel (unbalanced) observations: 15444

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.032753	0.010804	3.031386	0.0024
CHNG	-0.047337	0.023893	-1.981242	0.0476
WIN(-1)*CHNG	-0.000412	0.029523	-0.013972	0.9889
LOSS(-1)*CHNG	0.018851	0.025458	0.740457	0.4590
POS	-0.032575	0.003690	-8.828522	0.0000
POSO	0.072160	0.002978	24.23480	0.0000
HOME	1.797803	0.032611	55.12893	0.0000
C	-1.222995	0.055488	-22.04066	0.0000

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.250070	Mean dependent var	-0.000194
Adjusted R-squared	0.203551	S.D. dependent var	2.134034
S.E. of regression	1.904498	Akaike info criterion	4.183004
Sum squared resid	52741.82	Schwarz criterion	4.630000
Log likelihood	-31398.16	F-statistic	5.375624
Durbin-Watson stat	1.996516	Prob(F-statistic)	0.000000

Fixed Effects (Two-Way)

5. Comments:
   - Negative intercept (In this case again of secondary relevance due to estimation procedure chosen by software)
   - Significant controlling variables ($GODI_{t-1}$, POS, POSO, HOME), very similar estimates compared to FE (1-way)
   - Estimated time effects are small and seem insignificant
   - Effects of CHNG again unclear

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GODI(-1)	0.032753	0.010804	3.031386	0.0024
CHNG	-0.047337	0.023893	-1.981242	0.0476
WIN(-1)*CHNG	-0.000412	0.029523	-0.013972	0.9889
LOSS(-1)*CHNG	0.018851	0.025458	0.740457	0.4590
POS	-0.032575	0.003690	-8.828522	0.0000
POSO	0.072160	0.002978	24.23480	0.0000
HOME	1.797803	0.032611	55.12893	0.0000
C	-1.222995	0.055488	-22.04066	0.0000

Random Effects (One-Way)

1. Introducing remarks:
   - Assumes that unobserved effects are uncorrelated with explanatory variables
   - Accounts for unobserved differences between clubs (individual effects) but neglects common effects over time
   - A priori: Individual effects „make sense“, but small individual dimension (N=39) compared to large time dimension (T=858) rather favours the view of non-random effects
2. Theoretical model:

$$y_{it} = \alpha + \beta' X_{it} + \mu_i + \nu_{it} \qquad \mu_i \sim i.i.d.\left(0, \sigma_\mu^2\right) \qquad \nu_{it} \sim i.i.d.\left(0, \sigma_\nu^2\right)$$

3. Estimated model:

$$GODI_{it} = C + C(2)*GODI_{i,t-1} + C(3)*CHNG_{it} + C(4)*CHNG_{it}*WIN_{i,t-1} + C(5)*CHNG*LOSS_{i,t-1} + C(6)*POS_{it} + C(7)*POSO_{it} + C(8)*HOME_{it} + \mu_i + \nu_{it}$$

Random Effects (One-Way)

4. Estimation output of different error component variance estimators:

Random Effects (1-way, individual effects)			
Dep. Var: GODI	**Swamy/Arora**	**Wallace/Hussain**	**Wansbeek/Kapteyn**
GODI(-1)	0.043662***	0.033147***	0.032207***
CHNG	-0.034848 (p=0.1113)	-0.040928* (p=0.0635)	-0.041235* (p=0.0609)
WIN(-1)*CHNG	-0.006724	-0.003580	-0.002810
LOSS(-1)*CHNG	0.026385	0.016917	0.017035
POS	-0.066386***	-0.039505***	-0.037251***
POSO	0.072059***	0.071739***	0.071715***
HOME	1.825248***	1.801744***	1.799455***
C	-0.934452***	-1.366581***	-1.420928***
R^2	0.222831	0.209035	0.208397
σ_μ	0	0.258140	0.349146
σ_v	1.858934	1.8648601	1.858934
θ	0	0.760544	0.821164

Random Effects (One-Way)

5. Comments:

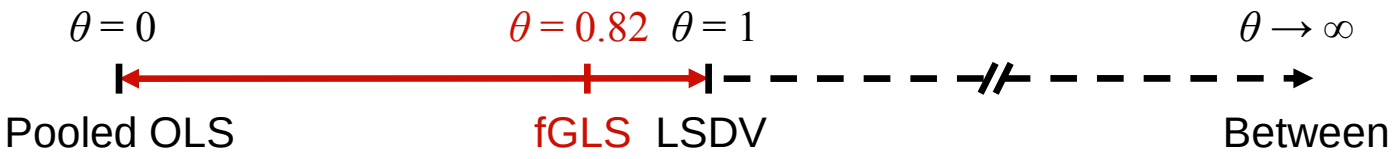
Random Effects (1-way, individual effects)			
Dep. Var: GODI	**Swamy/Arora**	**Wallace/Hussain**	**Wansbeek/Kapteyn**
GODI(-1)	0.043662***	0.033147***	0.032207***
CHNG	-0.034848 (p=0.1113)	-0.040928* (p=0.0635)	-0.041235* (p=0.0609)
WIN(-1)*CHNG	-0.006724	-0.003580	-0.002810
LOSS(-1)*CHNG	0.026385	0.016917	0.017035
POS	-0.066386***	-0.039505***	-0.037251***
POSO	0.072059***	0.071739***	0.071715***
HOME	1.825248***	1.801744***	1.799455***
C	-0.934452***	-1.366581***	-1.420928***
R^2	0.222831	0.209035	0.208397
σ_μ	0	0.258140	0.349146
σ_ν	1.858934	1.8648601	1.858934
θ	0	0.760544	0.821164

➔ Swamy/Arora (1972) seems not appropriate in this case, since it reports all indivdual effects to be zero

➔ Wallace/Hussain (1969) provides positive estimates for the individual effects, but Hausman-Test cannot be conducted

➔ Wansbeek/Kapteyn (1989) yields very similar estimates of covariates and effects but Hausman-Test can be conducted. This procedure obtaines $\theta = 0.82$:

$$\theta = 1 - \frac{\sigma_\nu}{\sqrt{T\sigma_\mu^2 + \sigma_\nu^2}}$$



Comparing the Different Models

Dep.Variable: GODI	[1] Pooled OLS	[2] Fixed Effects (1-way)	[3] Fixed Effects (2-way)	[4] Random Effects (1-way)
GODI(-1)	0.043662***	0.030453***	0.032753***	0.032207***
CHNG	-0.034848 (p=0.1157)	-0.041622* (p=0.0586)	-0.047337**(p=0.0476)	-0.041235* (p=0.0609)
CHNG*WIN(-1)	-0.006724	-0.000950	-0.000412	-0.002810
CHNG*LOSS(-1)	0.026385	0.018366	0.018851	0.017035
POS	-0.066386***	-0.033290***	-0.032575***	-0.037251***
POSO	0.072059***	0.071674***	0.072160***	0.071715***
HOME	1.825248***	1.794975***	1.797803***	1.799455***
C	-0.934452***	-1.217280***	-1.222995***	-1.420928***
R^2 / adj.R^2	0.206413 / 0.206105	0.243415 / 0.241203	0.250070 / 0.203551	0.208397 / 0.208038

- Explaining Variables have same significance within the different model spedifications, only significance of CHNG varies
- [2], [3], and [4] provide comparable coefficient and S.E. estimates

Choosing a Model

Tests	H_0	H_A	p-value	Proposed Model
F	Pooled OLS	Fixed Effects (1-way)	0	FE(1-way)≻ Pooled OLS ≻ FE(2-way)
	Pooled OLS	Fixed Effects (2-way)	1	
	Fixed Effects (1-way)	Fixed Effects (2-way)	1	
LR	Pooled OLS	Fixed Effects (1-way)	0	FE(1-way)≻ Pooled OLS ≻ FE(2-way)
	Pooled OLS	Fixed Effects (2-way)	1	
	Fixed Effects (1-way)	Fixed Effects (2-way)	1	
Hausman	Random Effects (1-way)	Fixed Effects (1-way)	0	FE(1-way)≻ RE(1-way)
Information Criteria (Akaike and Schwarz) also favour FE(1-way)				

- Different evaluation methods provide coherent results
- Fixed Effects (1-way) appears to be the most appropriate specification for the underlying data
- Perfectly in line with a priori considerations

Chosen Model: Fixed Effects (One-Way)

$$GODI_{it} = [-1.2173^{***}] + 0.0305^{***} \cdot GODI_{i,t-1} - 0.0416^{*} \cdot CHNG_{it} - 0.0010 \cdot CHNG_{it} \cdot WIN_{i,t-1}$$
$$+ 0.0184 \cdot CHNG_{it} \cdot LOSS_{i,t-1} - 0.0333^{***} \cdot POS_{it} + 0.0717^{***} \cdot POSO_{it} + 1.7950^{***} \cdot HOME_{it}$$
$$+ \mu_i + \nu_{it}$$

- ⊕ $GODI_{t-1}$: As expected, goal difference is a positive function of the past goal difference for all the three cases ($GODI_{t-1}$ =0, >0, <0)
- ? CHNG: Even though coefficient signs yields interesting insights, they remain weak since t-values and F-tests are not significant for alle the three cases ($GODI_{t-1}$ =0, >0, <0)
- ⊖ POS: Obviously, own strength is positively related to success (Own strength is measured by the proxy chart position, which is a decreasing function of strength)
- ⊕ POSO: Opponent‘s strength is negatively related to success (Opponent‘s strength is measured by the proxy chart position, which is a decreasing function of strength)
- ⊕ HOME: Not surprisingly, there exists a strong and highly significant home advantage

➔ Anticipated impacts of controlling variables are confirmed by the covariates estimates, while influence of interest (CHNG on GODI) remains unclear

Chosen Model: Fixed Effects (One-Way)

Dep.Variable: GODI	Fixed Effects (1-way)	Fixed Effects (1-way)	Fixed Effects (1-way)
GODI(-1)	0.030453***	0.030453***	0.030453***
CHNG	-0.041622* (p=0.0586)	-0.041622* (p=0.0586)	-0.041622* (p=0.0586)
CHNG*WIN(-1)	-0.000950 (p=0.9727)	-0.000950 (p=09727)	-0.000950
CHNG*LOSS(-1)	0.018366 (p=0.4406)	0.018366	0.018366 (p=0.4406)
POS	-0.033290***	-0.033290***	-0.033290***
POSO	0.071674***	0.071674***	0.071674***
HOME	1.794975***	1.794975***	1.794975***
C	-1.217280***	-1.217280***	-1.217280***
F-Test	p=0.1325	p=0.1437	p=0.0701

- Evaluation of the different cases ($GODI_{t-1}$ =0, >0, <0) regarding F-Tests and the t-value of the base group ($GODI_{t-1}$ =0) indicate no clear significance of $CHNG_t$ on ($GODI_t$)
- Therefore, we have no clear indication that the coach‘s decisions as a reaction on past success (shown earlier) singificantly influence success whatsoever the result in past game was

Chosen Model: Fixed Effects (One-Way)

Dep.Variable: GODI	Fixed Effects (1-way)	Fixed Effects (1-way)	Fixed Effects (1-way)
GODI(-1)	0.030453 (p=0.0035)	0.030453 (p=0.0035)	0.030453 (p=0.0035)
CHNG	-0.041622*	-0.041622*	-0.041622*
CHNG*WIN(-1)	-0.000950 (p=0.9727)	-0.000950 (p=0.9727)	-0.000950
CHNG*LOSS(-1)	0.018366 (p=0.4406)	0.018366	0.018366 (p=0.4406)
POS	-0.033290***	-0.033290***	-0.033290***
POSO	0.071674***	0.071674***	0.071674***
HOME	1.794975***	1.794975***	1.794975***
C	-1.217280***	-1.217280***	-1.217280***
F-Test	p=0.0144	p=0.0135	p=0.0080

➔ Evaluation of the different cases ($GODI_{t-1}$ =0, >0, <0) regarding F-Tests and the t-value of the base group ($GODI_{t-1}$ =0) indicate clear significance of $GODI_{t-1}$ (on $GODI_t$)

Chosen Model: Fixed Effects (One-Way)

	Club	Ind. Effect	Obs		Club	Ind. Effect	Obs
1	1860 München	**0.023028**	264	21	Bayer/KFC Uerdingen	-0.307683	363
2	Alemannia Aachen	-0.480458	99	22	1.FC Kaiserslautern	**0.027000**	858
3	Bayern München	**0.731727**	858	23	1.FC Köln	**0.361328**	858
4	Arminia Bielefeld	-0.313018	264	24	Bayer Leverkusen	-0.090010	396
5	VfL Bochum	-0.104594	660	25	Waldhof Mannheim	-0.260302	231
6	Bor. Neunkirchen	-1.349134	66	26	Bor. Mönchengladbach	**0.432669**	858
7	Eintr. Braunschweig	-0.184072	594	27	1.FC Nürnberg	-0.164694	495
8	Werder Bremen	**0.184825**	825	28	RW Oberhausen	-0.549832	132
9	BW 90 Berlin	-0.815350	33	29	Offenbacher Kickers	-0.440666	231
10	Darmstadt 98	-0.797142	66	30	Rot-Weiss Essen	-0.496608	231
11	Borussia Dortmund	**0.040195**	726	31	1.FC Saarbrücken	-0.441468	99
12	MSV Duisburg	-0.167549	561	32	Schalke 04	-0.099923	693
13	FC Homburg	-0.659677	99	33	FC. St. Pauli	-0.418882	132
14	Fortuna Düsseldorf	-0.182693	627	34	VfB Stuttgart	**0.231320**	792
15	Fortuna Köln	-0.748745	33	35	Stuttgarter Kickers	-0.502470	33
16	Eintracht Frankfurt	**0.138205**	858	36	Tasmania Berlin	-2.470812	33
17	Hamburger SV	**0.312917**	858	37	TeBe Berlin	-1.023995	66
18	Hannover 96	-0.235046	429	38	Wattenscheid 09	-0.326807	33
19	Hertha BSC Berlin	-0.123964	462	39	Wuppertaler SV	-0.529424	99
20	Karlsruher SC	-0.422444	429		Weighted Total	0	15444

Some Concluding Remarks

- Controlling variables are very significant and of expected nature, while impact of changes on success remain unclear (change → success):
  Therefore, we have no clear indication that the coach‘s decisions as a reaction on past success (shown earlier) singificantly influence success whatsoever the result in past game was
- Possible source of insignificant influence of interest (CHNG on GODI) for all three groups ($GODI_{t-1}$ =0, >0, <0):
  - ! Not possible to account for the distinction between forced exchanges and voluntary modification of the team line-up as a way to influence outcome
- Possible drawback of usage of data set:
  - ! „Unbalancedness“ is systematic
- Opposite direction (success → change) would be worth further examinations

Thanks for your attention!

Questions and comments VERY welcome…

andreas.brunhart@gmx.li

Quoted Literature

AKAIKE, H. (1974): "A New Look at the Statistical Model Identification", *IEEE Transactions on Automatic Control*, AC-19, p.716-723.

AMEMIYA, T. (1971): "The estimation of the variances in a variance-components model", *International Economic Review* 12, p.1-13.

ARELLANO, M. (1987): "Computing Robust Standard Errors for Within-Groups Estimators", *Oxford Bulletin of Economics and Statistics* 49, p.431-434.

BECK, N. AND J.N. KATZ (1995): "What to do (and not to do) with Time-Series Cross-Section Data", *The American Political Science Review* 89, p.634-647

BALTAGI, B. H. (2005): "Econometric Analysis of Panel Data".

HAUSMAN, J. A. (1978): "Specification Tests in Econometrics", *Econometrica* 46, p.1251-1271.

NICKELL, S (1981): "Biases in dynamic models with fixed effects, *Econometrica* 49, p.1417-1426.

SCHWARZ, G. (1978): "Estimating the dimension of a model", *Annals of Statistics* 6, p.461-464.

SWAMY, P.A. AND S.S. ARORA (1972): "The Exact Finite Sample Properties of the Estimators of Coefficients in the Error Components Regression Models", *Econometrica* 40, p.261-275.

WALLACE, T.D. AND A. HUSSAIN (1969): "The use of error components models in comining cross- section and time-series data", *Econometrica* 37, p.55-72.

WANSBEEK, T. AND A. KAPTEYN (1989): "Estimation of the Error Components Model with Incomplete Panels", *Journal of Econometrics* 41, p.341-361.

WHITE, H. (1980): "A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity", *Econometrica* 48, p.817-838.

WOOLDRIDGE, J.M. (2002): "Econometric Analysis of Cross Section and Panel Data".