THE IMPACT OF LOW FERTILITY ON AGEING IN THE REPUBLIC OF MACEDONIA

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Research question and, Main research goal

- Whether the economic conditions and opportunities within the rapidly ageing societies can lead to greater optimism or pessimism among the young regarding their own fertility plans?

- To examine if the tempo of period fertility rates and the quantum of late fertility affect the fertility ageing and the ageing process of population in general in respect of some economic conditions.

Goals

- Describe the impact of low fertility on ageing
- Explore the fertility trends and ageing process of fertility in the Republic of Macedonia
- Measure ageing and economic effects
- Predict the probability of increasing proportion of 65+

Data and Methods

- State Statistical Office of the Republic of Macedonia: Vital Statistics and Labor Force Survey (1996-2015)
- Basic economic indicators of the National Bank of the Republic of Macedonia (1996-2015)
- Time series of nine variables
- Exploratory factor analysis method, ML-Factor method and ML-Binary Logit method

ML-Factor method

- **The factor model assumes that for period *i* , *the observable multivariate p-vector* X_i *is generated by:***

$$X_i - \mu = LF_i + \epsilon_i$$

Macedonia, ML Factor model

Factor Method: Maximum Likelihood
Date: 06/22/16 Time: 21:46
Covariance Analysis: Ordinary Correlation
Sample: 1996 2015
Included observations: 20
Number of factors: Minimum average partial
Prior communalities: Squared multiple correlation
Convergence achieved after 16 iterations

	Unrotated Loadings			
	F1	F2	Communality	Uniqueness
WAGES	-0.238984	0.248602	0.118916	0.881084
MAFB	0.991737	0.120360	0.998028	0.001972
HIGHERMID	0.933086	0.254262	0.935298	0.064703
GDPG	0.036865	0.427486	0.184103	0.815908
FUN	-0.826018	0.558788	0.994551	0.005449
FE	0.962536	-0.199115	0.966121	0.033880
F30	0.992532	0.096113	0.994358	0.005642
CMR	0.903600	0.235010	0.871722	0.128279
AI	0.981178	0.139346	0.982127	0.017873

Factor	Variance	Cumulative	Difference	Proportion	Cumulative
F1	6.285766	6.285766	5.526307	0.892202	0.892202
F2	0.759459	7.045224	---	0.107798	1.000000
Total	7.045224	7.045224		1.000000	

	Model	Independence	Saturated
Discrepancy	2.263414	20.34343	0.000000
Chi-square statistic	43.00487	386.5251	---
Chi-square prob.	0.0013	0.0000	---
Bartlett chi-square	31.31056	308.5420	---
Bartlett probability	0.0373	0.0000	---
Parameters	26	9	45
Degrees-of-freedom	19	36	---

Goodness-of-fit Statistics and Indices

Goodness-of-fit Summary
Factor: FACTOR01
Date: 06/23/16 Time: 20:32

	Model	Independence	Saturated
Parameters	26	9	45
Degrees-of-freedom	19	36	---
Parsimony ratio	0.527778	1.000000	---

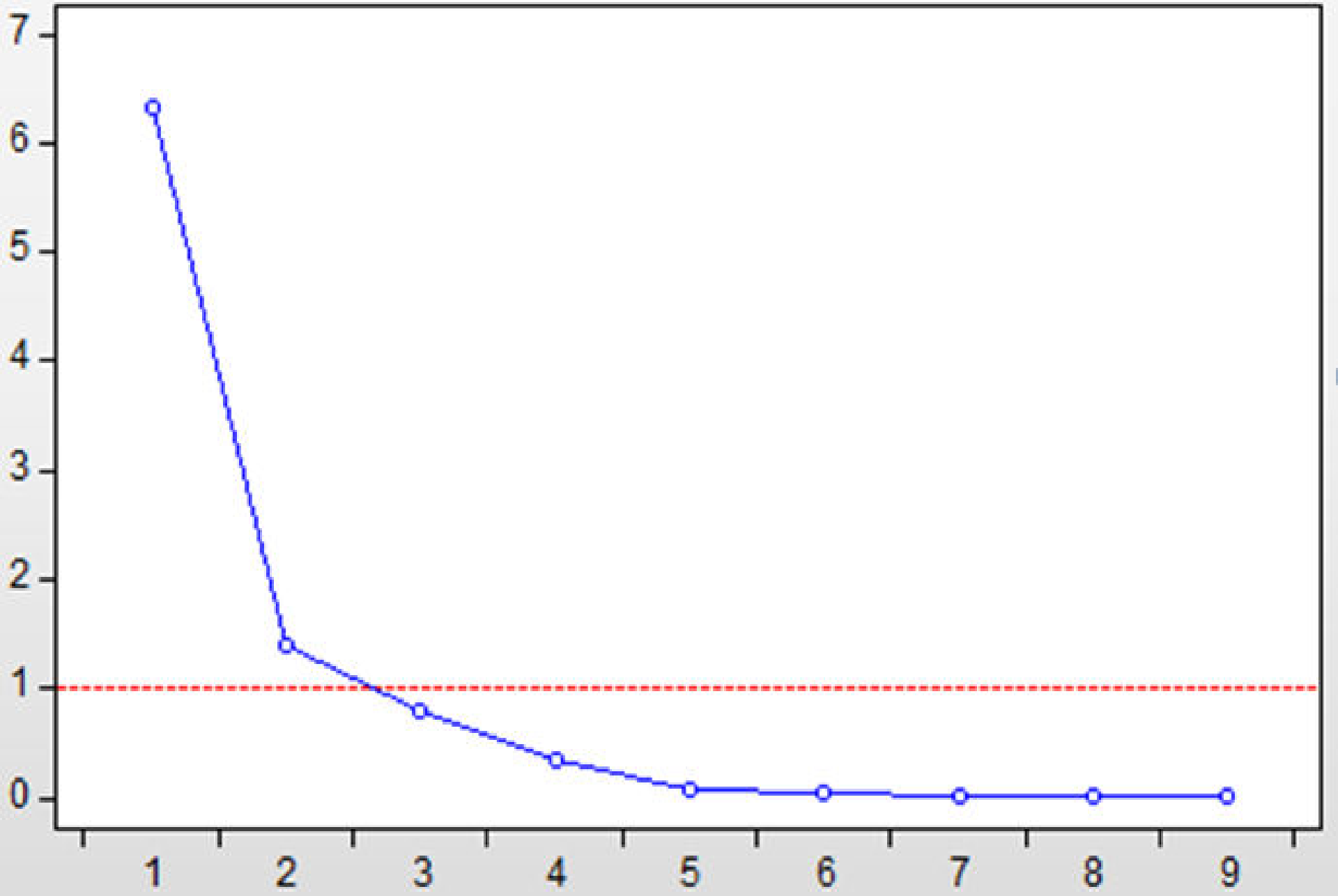
Absolute Fit Indices

	Model	Independence	Saturated
Discrepancy	2.263414	20.34343	0.000000
Chi-square statistic	43.00487	386.5251	---
Chi-square probability	0.0013	0.0000	---
Bartlett chi-square statistic	31.31056	308.5420	---
Bartlett probability	0.0373	0.0000	---
Root mean sq. resid. (RMSR)	0.037082	0.685817	0.000000
Akaike criterion	0.250243	15.72626	0.000000
Schwarz criterion	-0.695702	13.93394	0.000000
Hannan-Quinn criterion	0.065585	15.37638	0.000000
Expected cross-validation (ECVI)	5.000256	21.29080	4.736842
Generalized fit index (GFI)	0.665923	0.209962	1.000000
Adjusted GFI	0.208764	-0.871142	---
Non-centrality parameter	24.00487	350.5251	---
Gamma Hat	0.441810	0.051417	---
McDonald Noncentralilty	0.531683	9.86E-05	---
Root MSE approximation	0.257867	0.715866	---

Incremental Fit Indices

	Model
Bollen Relative (RFI)	0.789191
Bentler-Bonnet Normed (NFI)	0.888740
Tucker-Lewis Non-Normed (N...	0.870244
Bollen Incremental (IFI)	0.934685
Bentler Comparative (CFI)	0.931517

Eigenvalue view



Kaiser's Measure of Sampling Adequacy and partial correlation

Kaiser's Measure of Sampling Adequacy
Factor: FACTOR01
Date: 06/23/16 Time: 21:39

	MSA
WAGES	0.376167
MAFB	0.791660
HIGHERMID	0.922600
GDPG	0.417369
FUN	0.712938
FE	0.756606
F30	0.754344
CMR	0.946792
AI	0.849275
Kaiser's MSA	0.800036

Partial Correlation:

	WAGES	MAFB	HIGHERMID	GDPG	FUN	FE	F30	CMR	AI
WAGES	1.000000								
MAFB	0.404192	1.000000							
HIGHERMID	-0.067435	-0.172261	1.000000						
GDPG	-0.071453	0.147013	0.143258	1.000000					
FUN	-0.089098	0.413770	-0.011967	-0.165162	1.000000				
FE	-0.135092	0.379472	-0.242729	-0.293577	-0.875329	1.000000			
F30	-0.519953	0.905960	0.239802	-0.226328	-0.471700	-0.396878	1.000000		
CMR	0.259756	0.144168	0.290592	0.058646	0.010210	0.018974	-0.164244	1.000000	
AI	0.224018	-0.023791	0.382342	0.223755	0.436555	0.582565	0.306470	0.229959	1.000000

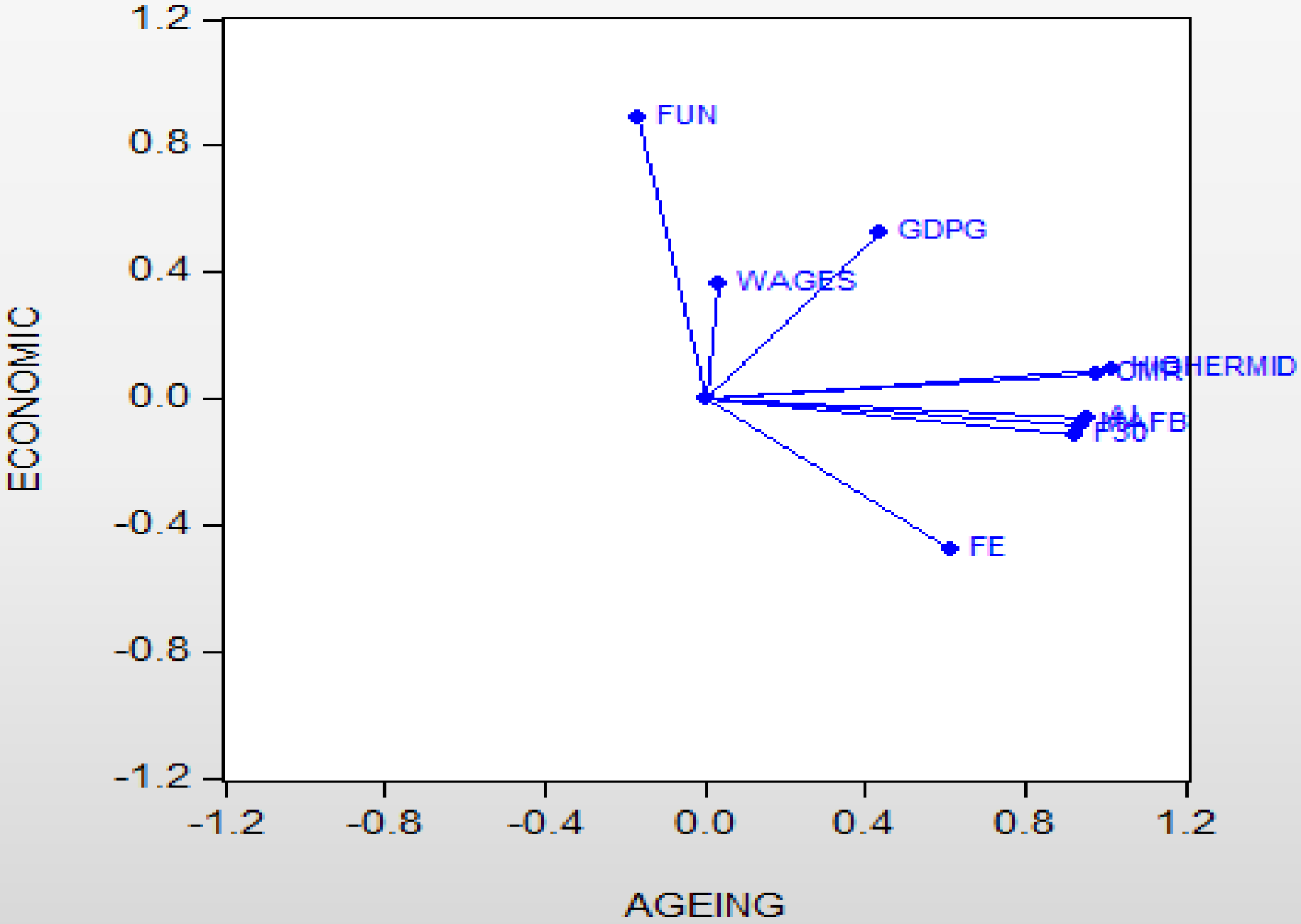
Rotation method:Oblique Quartimax

Rotation Method: Oblique Quartimax
Factor: FACTOR01
Date: 06/23/16 Time: 22:09
Initial loadings: Orthogonal Random (reps=25, rng=kn, seed=1911323643)
Results obtained from random draw 19 of 25
Convergence achieved after 23 iterations

Rotated loadings: L * inv(T)'

	F1	F2
WAGES	0.034899	0.365028
MAFB	0.943731	-0.086718
HIGHERMID	1.021173	0.093226
GDPG	0.434793	0.521160
FUN	-0.163299	0.889196
FE	0.617415	-0.475805
F30	0.921487	-0.116964
CMR	0.978303	0.076374
AI	0.952835	-0.060670

Oblique Quartimax rotated loadings



Factor score summary

Factor Score Summary
Factor: FACTOR01
Date: 06/24/16 Time: 01:29
Exact scoring coefficients
Method: Regression (based on rotated loadings)
Standardize observables using moments from estimation
Sample: 1996 2015
Included observations: 20

Factor Coefficients:

	AGING	ECONOMIC
WAGES	0.000450	0.002851
MAFB	0.709745	0.149847
HIGHERMID	0.026117	0.024575
GDPG	0.001435	0.004837
FUN	0.105894	1.080045
FE	0.015437	-0.078294
F30	0.236895	0.012278
CMR	0.012526	0.011190
AI	0.080478	0.026908

Indeterminancy Indices:

	Multiple-R	R-squared	Minimum Corr.
AGING	0.999215	0.998431	0.996861
ECONOMIC	0.996599	0.993209	0.986418

Factor score summary continue

Validity Coefficients:

	Validity
AGING	0.999215
ECONOMIC	0.996599

Univocality: (Rows=Factors; Columns=Factor scores)

	AGING	ECONOMIC
AGING	---	-0.613246
ECONOMIC	-0.611641	---

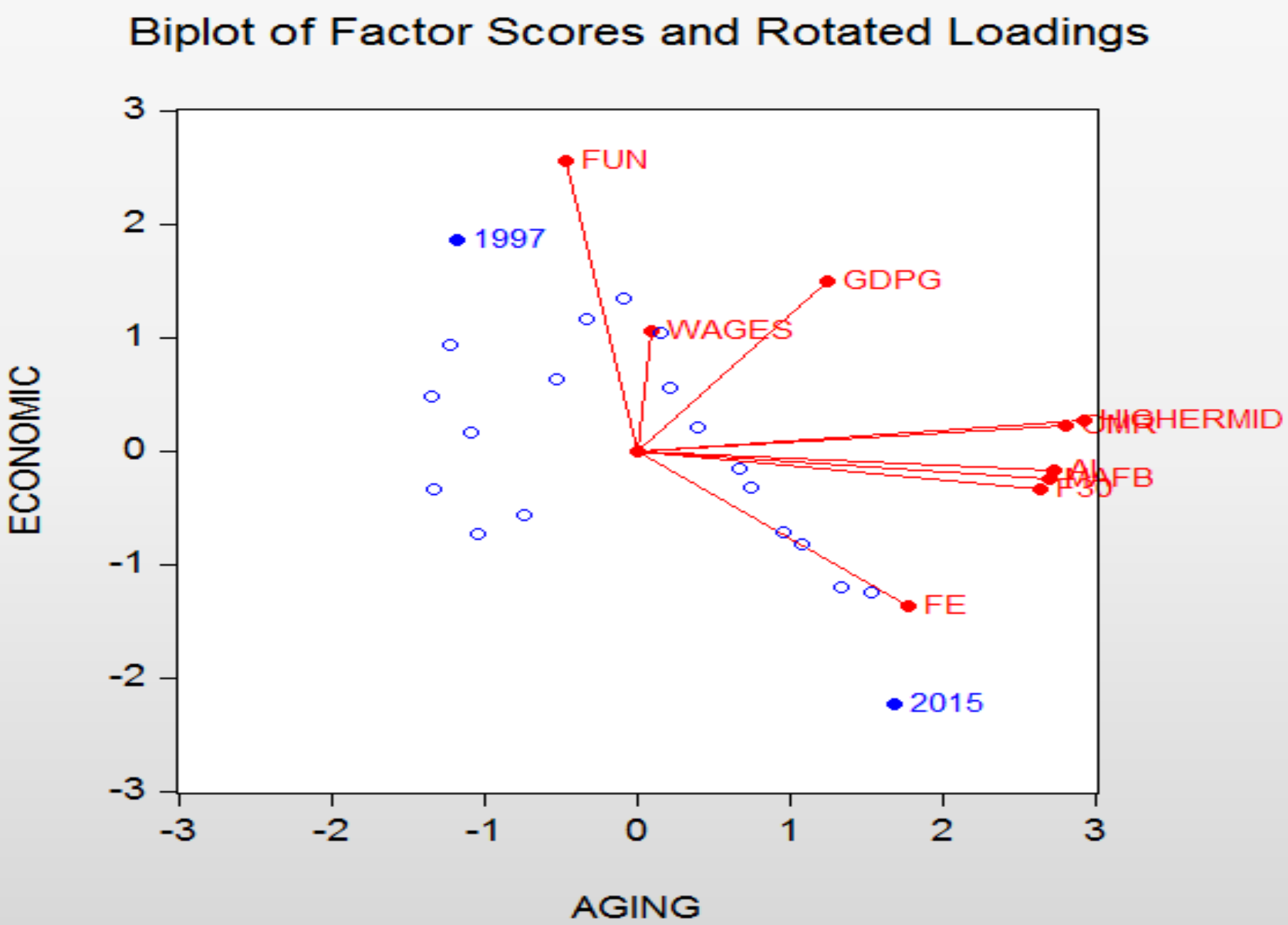
Estimated Scores Correlation:

	AGING	ECONOMIC
AGING	1.000000	
ECONOMIC	-0.613728	1.000000

Factor Correlation:

	AGING	ECONOMIC
AGING	1.000000	
ECONOMIC	-0.610223	1.000000

Biplot of factor scores and Rotated loadings



Logit model estimation

Dependent Variable: P65
Method: ML - Binary Logit (Quadratic hill climbing / EViews legacy)
Date: 06/23/16 Time: 15:27
Sample: 1996 2015
Included observations: 20
Convergence achieved after 6 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	47.04744	25.57958	1.839258	0.0659
TFR	-30.67305	16.85571	-1.819743	0.0688

McFadden R-squared	0.440341	Mean dependent var	0.500000
S.D. dependent var	0.512989	S.E. of regression	0.370641
Akaike info criterion	0.975852	Sum squared resid	2.472748
Schwarz criterion	1.075425	Log likelihood	-7.758522
Hannan-Quinn criter.	0.995290	Restr. log likelihood	-13.86294
LR statistic	12.20884	Avg. log likelihood	-0.387926
Prob(LR statistic)	0.000476		

Obs with Dep=0	10	Total obs	20
Obs with Dep=1	10		

ML-Binary Logit method

According to the estimated Logit model we get that the index s is equal to:

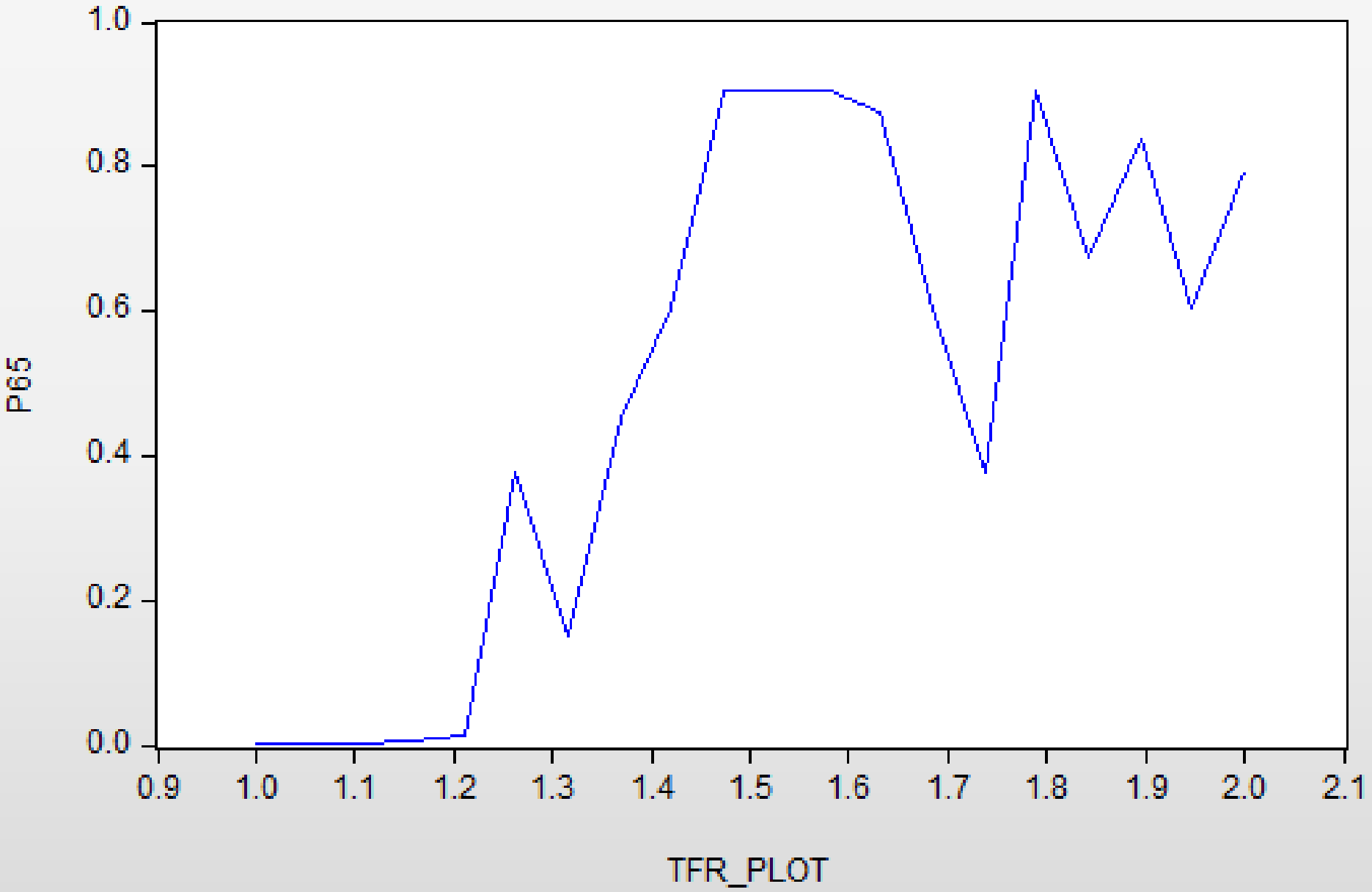
$$s = 47.047 - 30.674 * tfr\ ,$$

whereby the probability of increasing the proportion of 65+ is shown below:

$$prob(proportion\ 65+ = 1) = 1 - F(-s)$$

$$F(s) = e^s/(1 + e^s)$$

Probability of increasing the proportion 65+



Conclusions

- **TFR in 2015 is lowest in the Southwest region (1.19) of the country and highest TFR is observed in the Skopje region (1.79).**
- **In 2015, the age group of 25-29 is the leading one, with 34.6% of live births were belonged to the mothers aged 25-29, the age group 30-34 takes the second place in the share of live births with 28.0% of births.**
- **The proportion of fertility realized at age 30+ doubled from 19.13% in 1994 to 39.97% in 2015 in the Republic of Macedonia.**
- **The mean age at first birth was 23.4 years in early 1990s, it has increased to 27 years in 2015 in Republic of Macedonia**
- **Ageing process of fertility has received an significance and the population of Republic of Macedonia unavoidably will begin to accelerate its ageing process**

Conclusions

- **Medium negative correlation between FE30 and WAGES, FUN, FE, confirms their opposite linkage and therefore the key influence of the economic variables on ageing process of fertility.**

- **Medium positive correlation was revealed between MAFB and WAGES, FUN and FE. Also medium and positive correlation was found between AI and HIGHERMID and FUN and high positive correlation between AI and FE.**

- **The negative correlation between both factors (AGEING and ECONOMIC factors) means that the decrease of the effect of the economic factor will result in increase of the ageing process and that the decrease of the ageing process will lead to increase of the economic effect in the country.**

- **As the rate of TFR reduced to lowest values(1.45 to 1.65) it is more likely to increase the probability of increasing the proportion of 65+**

- **Research question interpretation.**

References

Adsera, A. (2011),Where Are the Babies? Labor Market Conditions and Fertility in Europe, *Eur J Population* (2011) ,Vol.27, pp.1–32.

Attané, I. & Barbiéri, M.(2009).The demography of east and southeast Asia from the 1950 to the 2000s, A summary of changes and a Statistical assessment, *Population-E*, 64 (1), pp.7-146

Basten, S.,Sobotka,T. & Zeman, K.(2014),˝Future fertility in low fertility countries˝, in Lutz,W., Butz, W.P.& Samir, K.C. (Ed.), *World Population and Human Capital in the Twenty-First Century,*Oxford University Press,Oxford, chapter 3.

Beets, G. (2007). An introduction:late fertility and determinants of postponement behaviour,*Genus*, 64 (3-4), pp.17-31.

Breschi, M. & Fornasin, A. (2004). Local fertility policy. *Genus*, 60 (1), pp.233-256.

Coleman, D.A.(2005).Population prospects and problems in Europe,*Genus,*61(3-4), pp.413-464

Fraboni, R.& Rosina, A.(2006). Age at first union and fatherhood in a very low fertility context.*Genus*, 62 (3-4), pp. 87-109

Giorgi,P.& Mamolo, M.(2007).Decomposition of late fertility dynamics across Italian regions during the period 1955-2000. G*enus*,63(1-2), pp.65-91

Goldstein, J.R. & Cassidy, T. (2014). A Cohort Model of Fertility Postponement, *Demography*, 51 (5), pp.1797–1819.

Preston, S.H., Himes, C. & Eggers, M. (1989). Demographic conditions responsible for population aging.*Demography*, 1989, 26 (4),pp.691-704

Tabutin, D. & Schoumaker, B. (2005).The Demography of the Arab world and the Middle East from 1950s to the 2000s.A Survey of Changes and a Statistical Assessment. *Population-E* 2005, 60 (5-6), pp.505-616

Thank You for your attention!

Questions? Comments?

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