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THE RELATION BETWEEN AGE STRUCTURE AND SAVING RATE OF TURKEY: 1968-2006

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ABSTRACT

Determination of saving behavior can be sought as a main issue for economies and can be handled with an extensive perspective regarding the relation between other macro economic policy variables. In this paper, saving rate in Turkey with age structure dimension is examined. As economic theory supports, age explains savings rate. Within the context probable long run relation between them is based on Modigliani's Life-cycle Model and in trying to shed light on the relation, cointegration tests were performed. The test results verify the relation and the empirical findings hold with life-cycle hypothesis of savings. That means, in Turkey, while stating any regulation to affect saving level, age structure influences are needed to be regarded.

Key Words: Life-cycle Saving Model, CRDW, CRADF, Johansen Test, ECM, Super Consistency

ÖZET

Ekonomiler için tasarruf davranışının belirlenmesi haklı olarak temel bir sorun olarak görülebilmekte ve diğer makro iktisadi politika değişkenleri ile ilişkisi bağlamında geniş bir perspektifte ele alınabilmektedir. Bu çalışma Türkiye'deki tasarruf oranını yaş yapısı boyutuyla incelemektedir. İktisat teorisinin de desteklediği gibi yaş, tasarruf oranını açıklar. Bu bağlamda değişkenler arasındaki olası ilişki Life-cycle Modeline dayandırılmıştır ve bu ilişki kointegrasyon testleri ile açıklanmaya çalışılmıştır. Test sonuçları ilişkiyi doğrulamaktadır ve deneysel bulgular da tasarruf hipotezine uymaktadır. Turkiye'de düzenlemeler yapılırken tasarruf seviyesine etki etmek için yaş yapısının etkisinin gözönüne alınması gerekmektedir.

Anahtar Kelimeler: ?????

INTRODUCTION

As a non-repudiatable reality in economies since saving is a key indicator and also sometimes manages decisions on other macro economic variables, to formalize many of the motives for saving appears as subject to be handled. Saving behavior is affected by several factors as age structure, income, expectations, uncertainties, public deficit, interest rate, social security system, inflation, social and cultural structure. It is possible to classify these ones as policy and non-policy factors. In real economic life, let's say, interest rate as one of the policy variables of which has effect on saving rate, doesn't reveal any results on its corresponding variables as expected. Namely it's hard to assert that a rise in interest rate will raise the savings in that economy since this increase will not affect the amount of savings but affect the composition of it -portfolio-, despite one can theoretically say an increase in interest rate will attract the funds. So the direction and power of the effect of it may not be predictable any time. This is just one of the complications of policy variables reflection on their corresponding variable saving rate. Supposing that, consideration of current deficit saving rate desired to be at high level, means to financing the investment saving required to be adequate to compensate these investments. Additionally savings that is not transformed to investment can be seen as leakage in that economy. So there is a counterbalance for the optimal level of saving. Here a study of Guest R.S. and McDonald I.M. (2004) examines optimal savings with impact of demographic transition in four Asian countries should be remembered. Thus considering all these complicated structure of saving behavior, afterwards of setting the relation and considering existing age structure in the country, it may be possible to see in which amount of savings provided by this structure in fact. Thereupon it will be less vague to interpret other policy variables that affect savings. At the juncture, it can be said that "age structure" variable can be seen among the non-policy factors and the age structure inherently has rather different structure in Turkey due to its young and dynamic population. The other studies with empirical contents in international literature discussed non-policy variables broadly; one is of Kelley and Williamson's (1968), other is of Gupta's (1971) and Thornton's (2001). On the other hand, not to be gone about the saving behavior from the age perspective in Turkey before, constitutes purposes of the study. So the motivation in the study is to explore the impact of age structure on saving rate in Turkey and the relation referred here is based to Modigliani's well known Life-cycle model (1970). The life-cycle model developed by Modigliani investigates level of saving in the economy and used variables which reflect age structure instead of other factors.

Investigation of suggested relation holds with an econometric method, that is cointegration analysis. Underlying purposes the paper's design as follows; section 1 covers a brief review for saving and age structure in Turkey, and section 2 introduces the data and the method which is an application of cointegration analysis to test expected long run relation, regarding almost last forty years. And the last section concludes.

I- SAVING AND AGE STRUCTURE IN TURKEY

As intuitions support, savings rates don't change significantly year to year, means almost a steady variable. Turkey's long term savings rate is 20 percent (1960-2005). Turkey's national savings has been decreasing ever following year since 1994. The program for 2008 states the ratio of national savings to GNP as 17.6 percent while the ratio is 19.2 percent in 2002. SPO data disclosures that the saving ratio in Turkey is at the lowest level since 1987 year (see Appendix-II).

Realized level of saving rate in 2003 is 19.3 and this level gradually decreases in the following years 2004, 2005, 2006; respectively 20.3, 18.2, 16.0.

Table 1: Saving Rates in Turkey

YEARS	*SAVINGS RATE*
2000	18,2
2001	17,5
2002	19,2
2003	19,3
2004	20,3
2005	18,2
2006	16,0

Source: SPO

In detail, Table 2 reflects a deep insight to inter-terms differences of private saving rates.

Table 2: Private Saving Rates in Turkey

Terms	*Private Saving Rates*
1987-2005	27.7.
1987-1991	27.2.
1992-2001	28.1.
2002-2005	27.2.
2004-2005	24.7.

Source: Alpay Filiztekin and TSI (Hasan Ersel, 2006)

As the figures of savings displayed private savings rate sharply reduced especially within the last two years in Turkey. The figures of savings for some key terms are as given.

By the 1980's private saving had an increasing trend. In 1987-2005 term private sector increases its tendency of savings. Recent terms indicate reduction in saving rates. This attitude can be interpreted as private sector gets lower share from disposable income and not saves but continues to expend. This may occur due to ensure balanced government budget. Studies show that Turkey had an increasing trend in the aggregate saving rate after 1980.

The only sector that gives saving surplus (saving-investment) is households. But, of course, the other two sector, public and corporations can restrict the share of this sector. If the desired case is households to save more, government may get less tax, and corporations may increase the share of dividend. Surely there are other economic and demographic factors that affect the savings rate of nations; age, income, expectations, uncertainties, inflation, social and cultural structure. All these variables reflect their effects to saving decision of them. Of which influences not discussed broadly, but Tansel (1992) studied the relationship between household saving, income, and the number of children that are some of the factors mentioned above. Besides an international empirical evidence provided by Edwards (1994); he finds some evidence that the age dependency ratio (the fraction of the population either younger than 15 or older than 65 years of age) is negatively related to domestic saving rates.

In detail there exists most of considerable variables should be contemplated. Some evaluations lead us to think not economic factors but social cultural and demographic factors mostly affect it. Here the study intensifies through the age structure, population.

Population can be divided into three categories as age groups; younger population (0-14), adolescent population (15-64) and old population (65+…).

Toros (2003) cited three phases for population development of Turkey. These are of (1925-35), (1960-70) and (1985-...). First phase meets to early formation of a republic and modernity efforts. Second one is formation of planning. And the final one is passing to modern life. He asserted that Turkish demographic structure lives a transformation for last decade.

Another classification can be said concerning to individual's labour force participation status; one is for age group of (0-14) and (65+) so covers the part needs to be cared namely, dependent. Other is for age group of (15-64) so covers working age.

In Turkey the share of working age in total has been gradually increasing, and that is supposed to enforce the tendency of saving more, as Table 3 supports.

Table 3: Percantage distiribution of population by age group in Turkey

	0-14	*15-64*	*65+*
1990	35,0	60,7	4,3
2006	28,1	66,0	6,0
2015	25,3	68,2	6,6

Source: TSI and SPO Data

Also Işık, (2001) interpreted last decades and accordingly remarked the most dramatical change falls on this working age group and emphasizes that this group will become greater both in number and in ratio.

Other aspect Toros (2003) evaluates that the dependent group becomes to reduce during the term 1975-1985. While every 100 people take care of 82 people, today working age take care of 60 people. Next years these figures will be as every 100 to 50.

II- DATA, METHODS AND FINDINGS

A simplified version of Modigliani's (1970) life-cycle model for savings rate was employed in Thornton (2001) study, and similarly here this paper embraced the model with the following form;

$$SR = \alpha_0 - \alpha_1 Dep - \alpha_2 Age$$

where variables SR, Dep, Age denote respectively National Saving Rate, Dep group (0-14) / Working Age and Age group (65+) / Working Age.

Modigliani's life-cycle model states that in the long run, age and saving is in relation. This economic theory constitutes a theoretical base for cointegration analysis, and mainly cointegration analysis passes through these steps; pretesting the variables for the order of integration, estimating the long run equilibrium relationship and finally estimating the error correction model and its adequacy. Similarly the paper will follow these stages.

Primary concern of analysis is to check whether the time series variables are nonstationary, that is, whether they have means, variances and covariances that are time dependent. Since it's necessary that the order of integration of all the variables in the long run relationship be the same (Enders, 219).

Unit root models can be expressed with well known forms; constant or/both trend. It's required to determine which form is appropriate for the ADF model. So checking line graph of the series is a simple way to identify the existence of trend and also constant. Within the context the forms are stated for all three variables and it can be seen that Dep variable just has decreasing trend while the other two variables have no trend as expected.

Below ADF and PP test results are listed in Table 3 and Table 4.

Table 4: (Levels)

	SR		*Dep*		*Age*	
	ADF	*PP*	*ADF*	*PP*	*ADF*	*PP*
- *Constant Test Statistics* - *Probability* - *Lag*	-2.1425 0.2299 0	-2.2008 0.2093 1			-2.5171 0.1197 1	-2.4066 0.1467 1
- *Constant & Trend ADF Test Statistics* - *Probability* - *Lag*			-3.8838 0.0242 5	-2.3185 0.4143 1		

Note: %5 critical value for ADF test with constant is -2.94 while it is -3.544 for the test with constant and trend.

Table 5. (First Differences)

	SR		*Dep*		*Age*	
	ADF	*PP*	*ADF*	*PP*	*ADF*	*PP*
- Constant Test Statistics *- Probability* *- Lag*	-4.3570 0.0014 1	-4.0525 0.0032 1			-5.2731 0.0001 0	-5.088 0.0002 1
- Constant & Trend ADF Test Statistics *- Probability* *- Lag*			-1.2679 0.8795 2	-8.5063 0.0000 1		

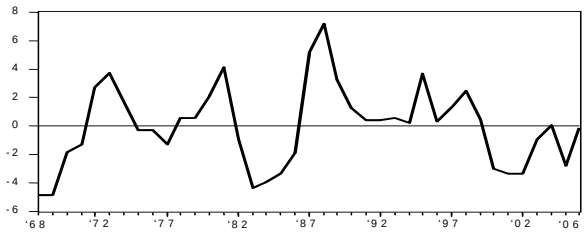
Note: %5 critical value for ADF test with constant is -2.94 while it is -3.544 for the test with constant and trend.

Based on the evidence of the outcome of the test, at level all the variables are nonstationary. However, there is no need to check the series for structural break. Variables are not expected to have level change since Age and Dep are derived from population data, which doesn't generally show significant change over years and SR is structurally stable in long term. Variables became stationary after the first differences (See Table.5). That means the variables of the model are integrated at level 1, I(1). If the series are all I(1) then it's difficult to reject the hypothesis of no relationship between them. This may evoke spurious regression concept. Spurious regression entails higher R^2 results when compared to Durbin-Watson statistic. Hence before moving through the mentioned steps above definitely a spurious regression results should be assessed. For the purpose the form stated here;

$$SR = 52.7656 - 22.8126\,DEP - 245.509AGE$$
$$(-5.921)\ (-4.3364)$$
$$R^2 = 0.57\ DW = 0.73$$

Since here R^2 is not higher than DW, no ground for suspicion of spurious regression. Having the same level of the order of integration and nonexistence of spurious regression relation lead to cointegration analysis and the next step is to show whether the linear combination of them is stationary. So residual will be preliminary to test cointegration. Here residuals of cointegrating regression are considered it's seen that they rarely drift from zero;

Figure 1. Residual term line graph



The verification of this initial result can be done with CRDW (Cointegrated Regression Durbin Watson) and CRADF (Cointegrated Regression Augmented Dickey Fuller) test.

The null hypothesis of CRDW test is H_o: DW = 0, which means no cointegration (DW statistics is less than 0.48). CRDW test statistic ascertains cointegration relation since the score is 0.73 > 0.48 for 5% critical value.

The null hypothesis of CRADF test is H_o: no cointegration, which means test statistics is greater than critical value. See Appendix-I.

Critical Values were prepared for 50, 100 and 200 observation. But MacKinnon (1990) explains how to calculate exact critical values.

$$CV_{N;\,T} = \beta_\infty + \beta_1 T_N^{-1} + \beta_2 T_N^{-2}$$

N = number of variables

T = number of observations

β_∞ : Estimated Asymptotic Critical Values

β_1 : Coefficient on T^{-1} acquired from simulation studies

β_2 : Coefficient on T^{-2} acquired from simulation studies

$$CV_{3;\,39} = -3.7429 - 8.352/39 - 13.41/39^2 = \text{-}3{,}9658$$

So for 5% critical value CRADF test statistics -4.402876 < -3.9658 that is calculated for 39 observation and three variables. Findings again reveal the existance of cointegrating relation.

An expansion on consistency property of estimation can be plausible here. When series are I(0) it can be said that OLS estimates of the model consist of these stationary series are consistent. Being a large sample property, as the number of observation increases they converge their true parameter values. But if the series are I(1) and the series are cointegrated then OLS estimates are super consistent. (Stock, 1987) Super consistency is a large sample property. Having cointegration

relation makes estimator converge to its true value much faster than estimator of model with stationary series. Super consistency doesn't have to hold classical regression assumptions. In other words, it implies that when sample size grows convergence is much quicker in the CI (1, 1) case. Since true value of parameter is proportional to the inverse of the sample size, say T for sample size, T^{-1} rather than $T^{-1/2}$ (in the case that stationary series' model) (Baltagi, 640). Thus, it can be suggested that estimates done in the paper are super consistent.

Johansen test which is actually based on Maximum Likelihood method is one of multivariate test. In fact the test looks for any combinations of the variables are cointegrated.

Table 6. Johansen Cointegration Test (Test of the number of the long-run equilibrium relationship)

Trace Test				*Maximum Eigenvalue Test*			
Null	***Altern.***	***Statistics***	***95% critical value***	***Null***	***Altern.***	***Statistics***	***95% critical value***
r = 0	r = 1	51.25954*	42.91525	r = 0	r = 1	27.18817*	25.82321
r ≠ 1	r = 2	24.07137	25.87211	r ≠ 1	r = 2	19.76235*	19.38704
r ≠ 2	r = 3	4.309019	12.51798	r ≠ 2	r = 3	4.309019	12.51798

* Indicates significance at 5 % level
r is number of cointegrating vectors.

According to Johansen test's decision rule; if the values of the test statistics λ_{trace} and $\lambda_{\max}$ * is less than critical value $\lambda_{95\%}$, null hypothesis there is cointegration can not be rejected. Since $\lambda_{\max}$ ve $\lambda_{trace} > \lambda_{table}$ means cointegrated variables, both tests on the Table 5 indicates one cointegrating equation for this model.

All test processes (line graph, CRDW, CRADF, Johansen) verify existance of cointegration relation. Cointegration remarks the existence of a long-run equilibrium, ECM links the long run equilibrium relationship with the short run dynamic adjustment which describes how the variables react when they move out of long run equilibrium (Zivot, 441). An error correction model (ECM) was estimated to capture both the long run and the short run dynamics of the saving rate behaviour. Mentioned long run relationship is the eqilibrium to which the system converges over time, and the disturbance term can be interpreted as the disequilibrium error or the distance that the system is away from the equilibrium at time t.

When the coefficients of the lagged residual term are negative, it suggests that the system comes back to the lung run path or adjusts. Involving the cointegrating regression residuals ECM can be modeled through this following general dynamic specification of the relation between Y and X like;

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta Y_{t-1} + \alpha_2 \Delta Y_{t-2} + \alpha_3 \Delta X_t + \alpha_4 \Delta X_{t-1} + \alpha_5 \Delta X_{t-2} + \alpha_6 (ECM) + \varepsilon_t$$

$H_0 : \alpha_6 = 0$

If the null hypothesis can not be rejected, there is no error correction mechanism operating and so the variables are not cointegrating.

Several lag forms of variables were tested and the choice process of the fit model was done according to AIC criteria. The decided model is as below;

* Eigenvalues of coefficient matrix.

Table 7: Estimation Results of the Error Correction Model

Dependent Variable: D(SR)
Method: Least Squares
Included observations: 38 after adjustments

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	0.998287	0.498962	2.000726	0.0535
D(Age)	-136.0951	59.55704	-2.285123	0.0287
D(Dep)	3.218038	33.66004	0.095604	0.9244
ECM(-1)	**-0.360400**	**0.125152**	**-2.879707**	**0.0068**

R-squared	0.259137	Mean dependent var	0.315789
Adjusted R-squared	0.193766	S.D. dependent var	2.383562
S.E. of regression	2.140212	Akaike info criterion	4.458988
Sum squared resid	155.7373	Schwarz criterion	4.631365
Log likelihood	-80.72077	F-statistic	3.964135
Durbin-Watson stat	1.429396	Prob(F-statistic)	0.015869

Coefficient of ECM (-1) is different from zero and significant according to t-test. That means model is not in the equilibrium and needs to be adopted in the short run.

In fact according to Engle and Granger (1987), the existence of the cointegration implies causality among the set of variables. As a further step causality can be proved.

CONCLUSION

For Turkey there is a limited number of studies on savings behaviour in literature, one is argue of Özcan (2001). This motivation determined the purpose of the paper. Another ground that might be expressed here, is to handle rarely used cointegration tests in econometrics with a different methodogical way, since, for now, the long run relation between economic variables has been commonly discussed with well known Johansen Cointegration test in the literature. In the study, long run relation was founded among Turkey's age structure and saving rate during 1968-2006. Additionally it's seen that for both groups (0-14) and (65+) that represent Dep and Age group are significant and reverse impact on saving rate as expected. The process tested by CRDW, CRADF and Johansen. These test results strengthened each other. In short run ECM used to correct the long run error of the model. It's noticed that the disequilibrium in the long run saving behaviour reaches stability after adjustment that is determined within the model constituted variables' terms differences. The emprical findings approve the prominency of explaning saving behaviour with age structure and the results point that governmental regulations might be done regarding the dissimilar structure of age in Turkey and this point might be helpful to decision makers from different fields in prediction and studies.

REFERENCES

Baltagi, B. (2003), **A companion to Theoritical Econometrics**, Blackwel Publishing, Germany.

Cromwell, J. Hannan M. Labys and W. Terraza M. (1994), Multivariate Tests for Time Series Models, **Sage University Paper**.

Edwards, S. (1994) "Why Are Saving Rates so Different Across Countries? An International Comparative Perspective", **NBER Working Paper** No. 5097.

Enders, W. (1995), **Applied Econometric Time Series**, John Wiley and Sons: New York.

Engle, R. and Granger C.W., (1987), "Co-integration and error correction: representation, estimation and testing", **Econometrica**, 49, 661-692.

Ersel, H. (2006), "Tasarruf Eğilimindeki Değişme", **Referans Gazetesi**, Arşiv, 12.10.2006.

Guest, R.S. and Mcdonald, I.M. (2004), "Demographic Transition and Optimal Saving In Four Asian Countries", **Economic Analysis & Policy**, Vol. 34, No. 1, 1-13.

Gupta, K. L. (1971) "Dependency Rates and Savings Rates: Comment", **American Economic Review**, Vol. 61, 469-71.

Işık, O. (2001), "2020 Yılında Nasıl Bir Demografik Tablo", www.ttb.org.tr

Kelley, A. and Williamson, J. (1968), "Household Saving Behavior in the Developing Economies: The Indonesian Case", **Economic Development and Cultural Change**, Vol. 16, No. 3, 385-403.

MacKinnon, J. (1990), "Critical Values for Cointegration Tests", Discussion Paper, **University of California San Diego**.

Modigliani, F. (1970), The life-cycle hypothesis of saving and intercountry differences in the saving ratio. In Induction, growth and trade: Essays in honour of Sir Roy Harrod. Edited by Walter A. Eltis, Maurice G. Scott, and James N. Wolfe. **London: Clarendon / Oxford University Press**, 197-225.

Özcan, K.M., Günay, A. and Ertaç, S. (2003), "Determinants of Private Savings Behaviour in Turkey", **Applied Economics**, 35, 1405-1416.

Tansel, A. (1992), "Household Saving, Income and Demographic Interactions", **Middle East Technical University Studies in Development**, 19, 91-114.

Thornton, J. (2001), "Age Structure and the Personal Savings Rate in the United States, 1956-1995", **Southern Economic Journal**, 68, 166-170.

Toros, A. (2003), "Demografiden Yeni Mesajlar", **Capital Aylık İş ve Ekonomi Dergisi**, Kasım sayısı.

Zivot, E. and Wang J. (2003), **Modeling Financial Time Series**, Springer Verlag, New York.

SPO, State Planning Organization

TSI, Turkish Statistical Institute

World Development Indicators

APPENDIX-I

N	Variant	Size	Obs.	β_∞	(SE)	β_1	β_2
1	no constant	1%	600	–2.5658	(.0023)	–1.960	–10.04
		5%	600	–1.9393	(.0008)	–0.398	0.0
		10%	560	–1.6156	(.0007)	–0.181	0.0
1	no trend	1%	600	–3.4336	(.0024)	–5.999	–29.25
		5%	600	–2.8621	(.0011)	–2.738	–8.36
		10%	600	–2.5671	(.0009)	–1.438	–4.48
1	with trend	1%	600	–3.9638	(.0019)	–8.353	–47.44
		5%	600	–3.4126	(.0012)	–4.039	–17.83
		10%	600	–3.1279	(.0009)	–2.418	–7.58
2	no trend	1%	600	–3.9001	(.0022)	–10.534	–30.03
		5%	600	–3.3377	(.0012)	–5.967	–8.98
		10%	600	–3.0462	(.0009)	–4.069	–5.73
2	with trend	1%	600	–4.3266	(.0022)	–15.531	–34.03
		5%	560	–3.7809	(.0013)	–9.421	–15.06
		10%	600	–3.4959	(.0009)	–7.203	–4.01
3	no trend	1%	560	–4.2981	(.0023)	–13.790	–46.37
		5%	560	–3.7429	(.0012)	–8.352	–13.41
		10%	600	–3.4518	(.0010)	–6.241	–2.79
3	with trend	1%	600	–4.6676	(.0022)	–18.492	–49.35
		5%	600	–4.1193	(.0011)	–12.024	–13.13
		10%	600	–3.8344	(.0009)	–9.118	–4.85
4	no trend	1%	560	–4.6493	(.0023)	–17.188	–59.20
		5%	560	–4.1000	(.0012)	–10.745	–21.57
		10%	600	–3.8110	(.0009)	–8.317	–5.19
4	with trend	1%	600	–4.9695	(.0021)	–22.504	–50.22
		5%	560	–4.4294	(.0012)	–14.501	–19.54
		10%	560	–4.1474	(.0010)	–11.165	–9.88
5	no trend	1%	520	–4.9587	(.0026)	–22.140	–37.29
		5%	560	–4.4185	(.0013)	–13.641	–21.16
		10%	600	–4.1327	(.0009)	–10.638	–5.48
5	with trend	1%	600	–5.2497	(.0024)	–26.606	–49.56
		5%	600	–4.7154	(.0013)	–17.432	–16.50
		10%	600	–4.4345	(.0010)	–13.654	–5.77
6	no trend	1%	480	–5.2400	(.0029)	–26.278	–41.65
		5%	480	–4.7048	(.0018)	–17.120	–11.17
		10%	480	–4.4242	(.0010)	–13.347	–0.0
6	with trend	1%	480	–5.5127	(.0033)	–30.735	–52.50
		5%	480	–4.9767	(.0017)	–20.883	–9.05
		10%	480	–4.6999	(.0011)	–16.445	–0.0

Source: Mackinnon (1990)

APPENDIX - II

Table 2.3: The Shares of total Domestic Savings in Gnp

YEARS	*SAVINGS RATE*	*YEARS*	*SAVINGS RATE*
1968	21,1	1988	27,2
1969	22,1	1989	22,1
1970	22,1	1990	22,0
1971	20,8	1991	21,4
1972	21,4	1992	21,6
1973	21,5	1993	22,7
1974	19,6	1994	23,1
1975	19,6	1995	22,1
1976	22,5	1996	19,9
1977	20,4	1997	21,3
1978	17,0	1998	22,7
1979	15,7	1999	21,2
1980	16,0	2000	18,2
1981	18,3	2001	17,5
1982	17,1	2002	19,2
1983	16,5	2003	19,3
1984	16,5	2004	20,3
1985	18,9	2005	18,2
1986	21,9	2006	16,0
1987	23,9		

Source: SPO