Structural Adjustment and Domestic Private Saving and Investment Interaction in Turkey: A Cointegration Analysis

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ABSTRACT

This study explores the direction of relationship, if there exists, between domestic private saving and investment in Turkey, with the primary focus on the impacts of structural adjustment reforms implemented in 1980. Using annual data over 1963-2002 periods and bivariate time series techniques, the study presents evidence that they are cointegrated in the pre-liberalization period, but not in its aftermath. Furthermore, the direction of the relationship between the two appears to run from savings to investment in the pre-reform period, pointing to the presence of a saving-driven investment process prior to 1980. However, the link between the two disappears after 1980 when Turkish economy became relatively open. Therefore, it seems that there does not exist an investment mechanism through which domestic saving rate enhances economic growth, at least in the Turkish case although the likely benefits of the policies that encourage saving may result from other mechanisms.

Keywords: Domestic Saving, Domestic Investment, Cointegration.

Türkiye'de Yapısal Reformlar ve Yurtiçi Özel Sektör Tasarruf-Yatırım Ilişkisi: Bir Eşbütünleşme Analizi

ÖZET

Bu çalışma, yurtiçi özel tasarruf-yatırım ilişkisini ve bu ilişkinin nedensellik yönünü Türkiye örneğinde incelemektedir. Bu doğrultuda, 1980 yılında başlatılan yapısal reformların etkileri de değerlendirilmektedir. 1963-2002 yıllarına ait yıllık veriler ve zaman serisi analizleri kullanılarak elde edilen bulgular, 1980 öncesi dönemde özel tasarruf ve yatırımlar arasında bir eşbütünleşmenin varlığını ortaya koyarken, 1980 sonrasında bu ilişkinin koptuğuna işaret etmektedir. Bununla birlikte, reform öncesi dönemde iki değişken arası bağıntı yönünün, tasarruflardan yatırımlara doğru olduğu görülmektedir. Türk ekonomisinin sermaye hareketliliklerine açık hale gelmesiyle birlikte, iki değişken arasındaki ilişkinin kaybolduğu ve dolayısıyla, tasarrufların yatırımları arttırarak ekonomik büyümeye neden olduğu yönündeki hipotezin, en azından Türkiye örneği için, geçerli olmadığı söylenebilir.

Anahtar Sözcükler: *Yurtiçi Tasarruflar, Yurtiçi Yatırımlar, Eşbütünleşme.*

I. INTRODUCTION

With the revival of interest in economic growth during the last two decades, attention has also been given to the factors that lead to high and sustainable growth. Among other things, saving rate has been viewed as an important determinant of economic growth (See for examples, Edwards, 1995 and Agrawal, 2001). Theoretical models of growth have established the link between saving and growth through its effect on capital accumulation. According to the growth model of Harrod-Domar with constant marginal returns to capital, the growth rate of output is related directly to the savings or investment. However, the growth model of Solow (1956) with decreasing marginal returns to capital

demonstrates that saving has no impact on long run (steady state) growth, but affects only the transition in between the two steady states. Accordingly, increases in saving are automatically transformed into capital formation and so in the short run growth rate becomes higher than the steady state level. When the economy reaches to another level of steady state, the effect of saving on growth disappears. Nonetheless, the model predicts that the higher the saving rate is, the greater the steady state income is in an economy. In contrast, the endogenous growth theory developed by Romer (1986) and Lucas (1988) suggests that the impact of a rise in savings and related capital formation on growth rate can be permanent[1].

In an open economy however, the strong link between the domestic saving and investment as predicted by the growth theories may disappear because domestic savings can be transferred to wherever the return is higher, in which case investment activities do not have to be financed by domestic savings. Hence, the relationship between them depends on the degree of openness of an economy to international capital movements. A frequently cited study by Feldstein and Horioka (1980, F-H hereafter) analyzes the correlation between saving and investment for 16 OECD countries and found that they are closely associated. This result was surprising because domestic saving and investment are expected to be loosely related to one another in relatively open economies. Interpreting this finding as reflecting a low degree of capital mobility has generated a voluminous body of literature, most of which have questioned the F-H interpretation of the domestic saving-investment correlation (Artis and Boyoumi, 1990; Coakley, *et al.*, 1996, 1998; Obstfeld and Rogoff, 2000; Sachsida and Caetano, 2000; Kasuga, 2004). For instance, Coakley *et al.* argued that a high correlation between them could simply imply that the current accounts are solvent, which may be partially due to the governments targeting current account balance. Other studies raised concerns over empirical implementation of the F-H and the choice of cross-country sample (Krol, 1996; Coiteoux and Olivier, 2000; Jansen, 2000; wu-Ho, 2002). However, their efforts yielded rather mixed results on the magnitude of the saving-investment correlation. Another approach on the saving-investment interaction is related with the development levels of the economies under study. While the studies by Dooley *et al.*, (1987), Wong (1990) and Isaksson (2001) found a weak correlation between them, those by Feldstein and Bacchetta, (1989) and Tesar (1991) documented a strong association between domestic saving and investment for developing countries.

At this point, it is also worth noting that the theoretical works identify an investment mechanism through which savings affect economic growth and strongly relate domestic savings to investment. However, it is unclear which one is the driving force from the theoretical perspectives (Schmidt, 2003:381). Despite this, there seems to be a conventional view that it is the savings that derive capital accumulation. If this is correct, policies to promote a high and sustainable growth should target at attaining a greater saving rate. However, the effectiveness of such policies depends not only on a strong link between domestic saving and investment, but also on the responsiveness of investment to saving-

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promoting policies. If only a small portion of investment results from domestic savings, meaning that investment is not a savings-driven process, such development policies are likely to be unsuccessful. This highlights the importance of the analyses not only on the correlation between domestic saving and investment but also on the direction of casual relationship, if any, between them.

Given the arguments above, this study investigates whether there exists a relationship between domestic saving and investment, and if so which one is the deriving force in Turkey. The availability of data from Turkey over a long time span (1963-2002) enables us to explore if the linkage between the two is influenced by the policies aimed at directing the economy from a closed to an open one. As is well known, in 1980, Turkey initiated a major structural adjustment reforms under the IMF supervision, liberalizing many aspects of the economy. This followed by the financial liberalization in 1982 and capital account liberalization in 1989. Removal of government control over interest rate, exchange rate and capital movements was the main step towards establishing a more market-oriented environment. Such developments are likely to alter the nature of the relationship between domestic saving and investment as they tend to affect the behaviors of both saving and investment and the mobility of international capital. Empirical analysis presented in this paper is based on a vector error correction representation (VECM) and the related variance decompositions[2]. As a result, this paper presents evidence that domestic investment responds to the changes in savings in the pre-liberalization period. More specifically, the results from the variance decompositions indicate more than 70% of variations in domestic investment can be attributed to the shocks to domestic saving. However, there seems no cointegrating vector that relates saving to investment in the long run in the post liberalization period.

This paper is organized as follows. The next section briefly describes the empirical framework based on the Johansen VECM approach. The following section presents the results and the last section concludes.

II. ECONOMETRIC METHODOLOGY

Johansen (1988, 1992) suggested a method to test for cointegration by considering the following *p* variable vector autoregressive model,

$$X_t = \mu + \sum_{i=1}^{k} \theta_i X_{t-i} + \eta_t \qquad (1)$$

where X_t is $(p{\times}1)$ vector of $I(1)$ variables at time t. η_t is the disturbance term assumed to be an i.i.d Gaussian process with mean zero and variance Ω. Although these variables are individually nonstationary, if there are linear combinations of these variables that are stationary, then they form a meaningful and stable long run relationship. Thus exploiting the notion that they are cointegrated, one may re-parameterize equation (1) to obtain the following vector error correction representation (VECM),

$$\Delta X_t = \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-k} + \eta_t$$

(2)

where Γ's are estimable parameters. Π is the long run parameter matrix whose rank determines the long run relationship between the variables. When the variables are integrated of order one and are cointegrated, Π is not a full rank, meaning $0 < rank\ (\Pi) < p$. The rank of Π is equal to r, indicating the number of cointagrating vectors. Based on the maximum likelihood estimation method, Johansen (1992) developed two test statistics to determine the r: the trace test and maximum eigenvalue test. The first entertains the hypothesis that the number of cointegrating vector is at most equal to r while the second tests the hypothesis that the number of cointegrating relationship is equal to r. Moreover, if the series are cointegrated, it is shown that Π matrix can be decomposed as $\alpha\beta'$, with α and β both ($p \times r$) matrices. β is the matrix of r cointegrating vector and α is the matrix of adjustment coefficients that show the speed at which the disequilibrium closes up in each short run period and so the variables move together toward the long run equilibrium.

III. EMPIRICAL RESULTS

Since the main focus is on analyzing the direction of a casual relationship between saving and investment to find out whether saving-promoting policies lead to more investment activities, it makes sense from a policy perspective to examine the responses of private sector saving-investment interactions rather than the responses of investment and saving at the national level. Also, increases in private sector saving may be offset by the changes in public saving, hindering any rise in saving-induced investment activities of the private sector. Thus, in contrast with the previous empirical work except for a study by Schmidt (2003) for the US, domestic private saving and investment definitions are used to capture the private responses of investment-saving relationship to a policy shock.

In the empirical analysis that follows, we employ a bivariate system, $X_t = (PI_t, PS_t)$, where PI_t and PS_t are respectively the ratios of gross domestic private investment and saving to GNP. The annual data on PI and domestic savings (private plus public) spanning from 1963 to 2002 are taken from the State Planning Organization's Economic and Social Indicators (2003). PS is obtained by subtracting the consolidated public sector definition of public saving from the total domestic savings. Figure 1 plots the PI and PS series over the sample period.
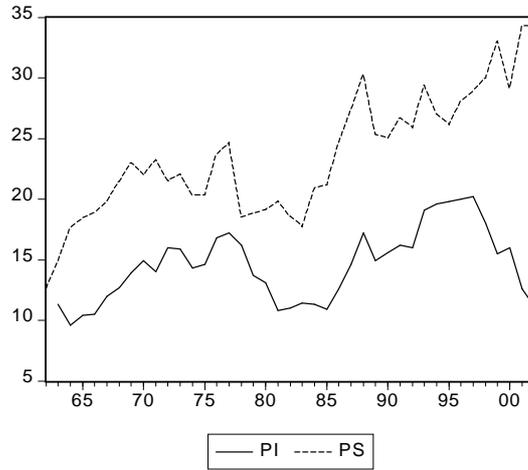
Figure 1

Both of the variables seem to move closely together and follow a similar trend until early 1980s, whereas their movements tend to depart from one another and the gap between them gets wider in the 1980s and 1990s. Starting point of such departures appears to coincide roughly with the implementation of liberalization reforms throughout 1980s and gets wider in the following decade[3].

First, the order of integration of each series in question is determined by performing augmented Dickey-Fuller (ADF) tests. The lag length for the augmenting term is selected according to Akaike information criterion (AIC) and Schwarz information criterion (SIC) in a way to make the error term as much white noise as possible. Table 1 reports the results of the ADF tests for unit root on both the levels and the first differences of the variables. The test statistics indicate that both PI and PS are integrated of order one in levels, but not in their first differences[4].

Table 1. Testing for Unit Root

Variables	ADFstat. Intercept & no trend	.ADFstat. Intercept & trend
PI	-2.22	-1.58
PS	-1.04	-2.33
ΔPI	-3.19	-3.61
ΔPS	-5.25	-5.17

Note: MacKinnon critical values at 5% are –3.52 and –2.93 respectively with and without trend.

Next, the Johansen test for cointegration is applied to the bivariate system (PI, PS) to see whether there exist any linear combinations of the two that have a common trend. Since the Johansen test is quite sensitive to the lag length selected,

the most commonly used criterions such as AIC, SIC, sequential likelihood ratio (LR) are utilized to determine the proper lag length, all of which suggest that one lag be included. The results of the Johansen test are reported in Table 2.

Table 2. Testing for Cointegration (Full Sample) lag 1

H_0	H_1	Trace stat.	95% CV	H_0	H_1	λ Max	95% CV
r=0	r≥0	5.98	15.41	r=0	r≥0	5.43	14.07
r≤1	r≥1	0.54	3.76	r≤1	r=1	0.54	3.76
Normalized Coefficients of Cointegrating Vector and Coefficients of Adjustment							
	PI	PS					
β'	1.00	0.009 (0.29)					
α	-0.172 (0.08)*	-0.179 (0.13)					

Note: * shows significant cases at 5% level. Figures in parentheses are standard errors.

As seen, both the trace and maximal-eigen value tests indicate the absence of a cointegrating vector at 5% level over the sample period from 1963 to 2002. Finding of no cointegration may be interpreted as the existence of a high degree of capital mobility or unsustainability of current account during the sample period. However, as mentioned earlier, the sample period covers two distinct phases in the Turkish economy. Prior to 1980, with a fixed exchange regime and a relatively closed economic condition, current account targeting was conceivable so that it was more likely that domestic private saving and investment were strongly related. Throughout 1980s, the Turkish economy experienced a number of liberalization attempts in which the central objective was to create a more open and market-oriented economic environment. Such policy regime shifts in 1980s are likely to influence the domestic saving-investment interaction as they tend to initiate international capital movements so that domestic investment can be financed through domestic saving as well as foreign saving.

To check whether the saving investment relationship is sensitive to a regime change, we divide the full sample period into two subsamples: pre-liberalization period (1963-1980) and the post period (1981-2002). Then the Johansen cointegration tests are applied separately to the two subsamples. The AIC and sequential LR test statistics suggest the use of three lags for the first sample period and of one lag for the second. Table 3 presents the results. The panel A of Table 3 shows the results of the cointegration analysis for the pre-liberalization period. According to both the trace and maximal-eigen value statistics, there exists a single cointegrating vector in the system. In contrast, the results from the post liberalization period presented in panel B show that they are not cointegrated. Domestic saving and investment form a meaningful and stable relationship in the long run during the relatively closed stages of the Turkish economy while the interaction between them seem to disappear after the introduction of liberalization reforms. These findings are consistent with the F-H interpretation of the S-I relationship as reflecting the degree of capital mobility.

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Table 3. Testing for Cointegration

Panel A: Pre-1980 Sample							
H_0	H_1	Trace stat.	95% CV	H_0	H_1	λ Max	95% CV
r=0	r≥0	13.39*	12.53	r=0	r≥0	11.61*	11.44
r≤1	r≥1	1.77	3.84	r≤1	r=1	1.77	3.84
Normalized Coefficients of Cointegrating Vector and Coefficients of Adjustment							
	PI		PS				
β'	1.00		-0.730 (0.022)*				
α	-0.593 (0.212)*		-0.891(0.391)				
Panel B: Post 1980 Sample							
H_0	H_1	Trace stat.	95% CV	H_0	H_1	λ Max	95% CV
r=0	r≥0	3.29	12.53	r=0	r≥0	3.09	11.44
r≤1	r≥1	0.20	3.84	r≤1	r=1	0.20	3.84
Normalized Coefficients of Cointegrating Vector and Coefficients of Adjustment							
	PI		PS				
β'	1.00		-1.296 (0.41)*				
α	0.008 (0.022)		-0.049 (0.031)				

Note: * shows significant cases at 5% level. Figures in parentheses are standard errors.

Further for the first subsample period, it is only the private investment that makes adjustments toward long run equilibrium, as the coefficient of adjustment on this variable is statistically significant. As suggested by Johansen (1992), performing a t test on the coefficient of adjustment provides a test procedure to determine weak exogeneity or endogeneity of the variables in question. Accordingly, the results suggest that the private investment can be considered to be an endogenous variable while the private saving weakly exogenous. These findings indicate that domestic private saving was the driving force behind investment activities of private sector in the pre-liberalization period. To further analyze the dynamic impact of a shock to one variable on the other, variance decompositions are obtained from the VECM estimates on panel A of Table 3 and are reported in Table 4[5]. If the direction of causality ran from saving to investment, shocks to saving would account for a large portion of the variation in private investment (Schmidt, 2003: 391). Consistent with the previous result, approximately 70% of the variation in private investment is associated with the innovations to private savings, indicating a saving-driven investment process before 1980. However, saving once again appears to be weakly exogenous since a small portion of variations is accounted for by the variations in private investment.

Table 4. Variance Decompositions for Pre-1980 Period

	Variance Decomposition of PI			Variance Decomposition of PS		
Period	S.E.	PI	PS	S.E.	PI	PS
1	0.727	100.00	0.00	1.681	6.90	93.09
2	1.315	39.44	60.55	1.985	6.76	93.23
3	1.594	29.25	70.74	2.633	17.26	82.73
4	1.643	33.07	66.92	2.783	25.90	74.09
5	1.651	33.76	66.23	2.793	26.41	73.58
6	1.747	34.14	65.85	3.169	22.47	77.52
7	2.070	26.87	73.12	3.679	16.70	83.29
8	2.383	22.87	77.12	3.954	20.29	79.70
9	2.508	28.74	71.25	4.106	25.95	74.04
10	2.525	29.60	70.39	4.106	25.95	74.04
30	5.711	29.70	70.29	8.784	30.26	69.73
Cholesky Ordering: PI PS						

Overall, the findings suggest that domestic private saving and investment are closely related in the long run and that a rise in saving generates higher investment spending in the pre-liberalization period. However, in the post period, there seems no long run relationship between the two. Thus, although saving-promoting policies might have been successful through stimulating investment and leading to high and sustainable economic growth before 1980, they seem ineffective in bringing about increased investment activities in the aftermath of 1980.

IV- SUMMARY AND CONCLUDING REMARKS

Along with the increasing interest in the recent advances in growth literature, the center of attention has been on the sources that lead to high and sustainable growth. Among others, saving rate was thought to play an important role in economic growth particularly through its association with investment. If this is the case, then policies to spur economic growth ought to be geared towards promoting higher saving rates. However, the success of saving-promoting policies depends heavily on two conditions. The first is that domestic saving is the major source of funds available for domestic investment due to the limited mobility of international capital. The second is that not only is there a close association between domestic saving and investment but also the direction of causality between them runs from saving to investment.

Motivated by these arguments, this study examined the question of whether saving policies would be effective in bringing about larger capital accumulation and so higher economic growth in Turkey. In doing so, the main focus was on capturing the responses of private sector to a policy shock. Accordingly, this paper used annual data spanning from 1963 to 2002 on domestic private investment and saving rather than total domestic saving and investment (public and private), in an effort to find out the direction of a casual relationship, if there is, between the two. The results from employing the bivariate

VECM procedure suggest that domestic private saving and investment are closely related and form a stable long run relationship before the structural adjustment reforms implemented in 1980. In addition, private investment activities are in large part determined by saving innovations during this period. However, such a linkage between them does not seem to hold after 1980.

These findings are consistent with the Feldstein and Horioka contention that the higher the degree of international capital mobility is, the weaker the association between domestic saving and investment will be. Since the Turkish economy has turned into a relatively open one with the introduction of liberalization reforms in 1980s, the degree of capital movements appears to have risen up, rendering any impacts of domestic private saving on investment obsolete. Because investment mechanism through which saving affects economic growth does not seem to function in the post liberalization period, saving-promoting policies aimed at encouraging private investment activities are likely to be ineffective in achieving an enhanced economic performance. This does not mean, however, that the saving rate has no effect on growth whatsoever, as there might be other channels through which the saving rate may influence growth. For instance, high saving rates may contribute to creating a sustainable current account deficit that may be valuable to growth process especially in developing economies experiencing major structural adjustments. Thus more research is needed to identify both theoretically and empirically other mechanisms that saving rate operates through to generate a high and sustainable economic growth.

NOTES
1. See for a detailed survey of growth theories, Barro and Sala-i Martin (1995).
2. Another study of domestic saving-investment relationship in Turkey was conducted Yıldırım (2001) that used an autoregressive distributed lag procedure (ARDL) with a dummy to control for a turning point in 1980. She found that the relationship between domestic saving-investment turns out to be weaker after 1980. However, unlike the present study, she does not analyze the direction of casual relationship between saving and investment. Also, another important departure of the present study is that because the main focus is on capturing the responses of private sector saving-investment interactions to a policy shock, we employ data on domestic private saving and investment rather than data on total (public and private) domestic saving and investment.
3. See for more on the behaviors of saving and investment in Turkey, Kıvılcım *et al*., (2003) and Günçavdı and McKay (2003).
4. Phillips and Perron (PP) unit root test yields basically the same results.
5. As is well known, the Cholesky decomposition is quite sensitive to the order of the variables. We use the PI PS ordering to obtain variance decompositions, but compare and contrast them with those from the PS PI ordering. This effort gives very similar results, which are available upon request.

REFERENCES

AGRAWAL, P. (2001), "The Relation between Savings and Growth: Cointegration and Causality evidence from Asia", Applied Economics, 33 (4), 499- 513.

ARICANLI, T. and RODRIK, D. (1990), "An Overview of Turkey's Experience with Economic Liberalization and Structural Adjustment". World Development, 18 (10), 1343-50.

ARTIS, M. J. and BOYOUMI, T. A. (Sep 1990), "Saving, Investment, Financial Integration and the Balance of Payments". IMF Staff Studies for World Economic Outlook, 19-34.

BARRO, R.J. and SALA-I-MARTIN, X. (1995), "Economic Growth". McGraw-Hill, New York.

COAKLEY, J., KULASI, F., SMITH, R. (May 1996), "Current Account Solvency and the Feldstein-Horioka Puzzle". Economic Journal, 106, 620-627.

COAKLEY, J., KULASI, F., SMITH, R. (1998), "The Feldstein-Horioka Ouzzle and Capital Mobility: A review". International Journal of Finance and Economics, 3, 55-78.

COITEUX, M. and OLIVIER, S. (2000), "The Saving Retention Coefficient in the Long-run and in the Short-run: Evidence from Panel Data". Journal of International Money and Finance, 19, 535-548.

DOOLEY, M., FRANKEL, J.A., MATHIESON, D. (1987), "International Capital Mobility in Developing Countries vs. Industrial Countries: What do the saving-investment correlation tell us?" IMF Staff Papers no. 34, 503-529.

EDWARDS, S. (1995), "Why are Saving Rates So Different Across Countries?: An International Comparative Analysis", NBER Working Paper, No: 5097.

FELDSTEIN, M. and HORIOKA, C. (June 1980), "Domestic Saving and International Capital Flows". Economic Journal, 90, 314-329.

FELDSTEIN, M. and BACCHETTA, P. (1989), "National Saving and International Investment", NBER Working Paper Series no. 3164.

GÜNÇAVDI, Ö. and McKAY, A. (2003), "Macroeconomic Adjustment and Private Manufacturing Investment in Turkey: A Time-series Analysis". Applied Economics, 35, 1901-1909.

ISAKSSON, A. (2001), "Financial Liberalization, Foreign Aid, and Capital Mobility: Evidence from 90 Developing Countries". Journal of Financial Markets, Institutions, and Money, 11, 309-338.

JANSEN, W. J. (2000), "International Capital Mobility: Evidence from Panel Data, Comment on Krol (1996)". Journal of International Money and Finance. 19, 507-511.

JOHANSEN, S. (1988), "Statistical Analysis of Cointegration Vectors". Journal of Economic Dynamics and Control, 12 (3), 231-254.

JOHANSEN, S. (1992), "Determination of the Cointegrating Rank in the Presence of a Linear Trend", Oxford Bullettin of Economics and Statistics, 54, 383-397.

HO, wu T. (2002), "The Feldstein-Horioka Puzzle Revisited". Journal of International Money and Finance, 21, 555-564.

KASUGA, H. (2004), "Saving-Investment Correlations in Developing Countries". Economic Letters, 83, 371-376.

KIVILCIM, M. Ö., GÜNAY, A, ERTAC, S. (2003), "Determinants of Private Savings Behavior in Turkey, Applied Economics, 35, 1405-16.

KROL, R. (1996), "Internaional Capital Mobility: Evidence from Panel Data". Journal of International Money and Finance, 15 (3), 467-474.

LUCAS, R. E. (1988), " On the Mechanics of Economic Development," Journal of Monetary Economics, 22, 3-42.

OBSTFELD, M. and ROGOFF, K. (2000), "The Six Major Puzzles in International Macroeconomics: Is there a common cause?" NBER Working Paper Series no. 7777.

ROMER, P. (1986), "Increasing Returns and Long-run Growth," Journal of Political Economy, 94, 1002-37.

SACHSIDA, A. and CAETANO, M. A. (2001), "The Feldstein-Horioka Puzzle Revisited," Economic Letters, 68, 85-88.

SCHMIDT, M. B., (2003), "U.S Saving and Investment: Policy Implications". Open Economies Review, 14, 381-395.

SOLOW, R. (1956), "A Contribution to the Theory of Economic Growth," Quarterly Journal of
      Economics, 70, 65-94.

SPO (2003) "Economic and Social Indicators: 1950-2003", Ankara.

TESAR, L. (1991), "Savings, Investment, and International Capital Flows". Journal of International
      Economics, 31, 55-78.

WONG, D. Y. (1990), "What do Savings-Investment Relationships Tell us about Capital Mobility".
      Journal of International Money and Finance, 9, 60-74.

YILDIRIM, J. (2001), "Saving-Investment Correlation: Evidence from Turkey". Yapı Kredi
      Economic Review, 12(1), 35-42.