Macroeconomic Instability, Capital Accumulation and Growth: The Case of Turkey 1963-1999*

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Abstract

This study investigates the empirical relationship(s) between macroeconomic instability, capital accumulation and growth in Turkey over the period 1963-1999. We use recent time series econometric techniques, such as cointegration and impulse response analysis. The results of this paper suggest that the chronic and increasing macroeconomic instability of the Turkish economy has seriously affected her capital formation and growth. Furthermore, the Turkish experience indicates that chronic macroeconomic instability seems to be a serious impediment to public investment, especially to its infrastructural component, and shatters, or even reverses, the complementarity between public and private investment in the long-run.

Key Words: Public Investment, Private Investment, Complementarity, Macroeconomic Instability

JEL Classification: E62, E63, C52

1. INTRODUCTION

Turkey and many other developing countries, such as those in Latin America, experienced chronic macroeconomic instability by following unstable macroeconomic policies over extended periods of time.[1] The typical developing country suffering from chronic macroeconomic instability tends to exhibit excessive and persistent budget deficit, high debt to GNP ratio, high and volatile inflation rate, and low and volatile rates of capital formation and economic growth. Furthermore, they tend to exhibit low level of public capital spending[2] as a share of output.

Many economists nowadays believe that macroeconomic instability[3] is detrimental to capital accumulation and economic growth, and there is empirical evidence that supports this view.[4] Theoretical arguments in this line of research focus on the detrimental effects of macroeconomic instability on private investment and productivity.[5] Moreover, early empirical studies, which assessed the effects of macroeconomic instability on investment, used aggregate investment (e.g. Bleaney, 1996) or private investment data (e.g. Cardosa, 1993) in their analyses.

Macroeconomic instability affects negatively both private and public investment, however, via different channels. While the rise in macroeconomic uncertainty is the main cause for a reduction in private investment, the increase in the level of fiscal stringency is the principal reason for the decrease in public investment. That is, a rise in the level of macroeconomic instability lowers the fiscal "ability" of the government to spend on public investment.[6] This is due to the existence of the budget constraint of the government. For example, high inflation rate and/or excessive debt accumulation lowers the financial resources otherwise available

[1]Developing countries may also experience macroeconomic instability as a result of structural characteristics such as vulnerability to external shocks.

[2] We will use the terms "public capital spending" and "public investment" interchangeably throughout this study.

[3]We define macroeconomic instability in line with Fischer (1993a,1993b) and Bleaney (1996). A rise in macroeconomic instability means a rise in one or more policy-induced macroeconomic instability indicators, such as inflation rate, public deficit to GNP ratio and external debt to GNP ratio.

[4]See, for example, Fischer (1993a, 1993b), Cardosa (1993), Briault (1995), Bleaney (1996) and Sanchez-Robles (1998).

[5]For instance, it is widely argued that macroeconomic instability adversely affects the rates of productivity and investment mainly by creating uncertainty about current and future macroeconomic environment. See, for example, Fischer (1993b) and Bleaney (1996).

[6]Recently new political economy literature has emphasized the role of political factors, such as political instability and polarization, on macroeconomic instability and the decline in public capital spending

for public investment.[7] Many recent empirical studies found positive effects of public capital spending, particularly infrastructural spending, on private investment, productivity and growth.[8] These studies suggest that a decrease in public capital spending can be harmful for economic growth. More importantly, given the detrimental effects of macroeconomic instability on public investment, these studies imply that chronic macroeconomic instability can be very costly in terms of private capital accumulation and hence economic growth if public and private investment are complementary (i.e. if public investment crowds-in private investment). Thus there seems to be an additional link between macroeconomic instability and economic growth due to the possible complementarity between public and private investment. This issue is neither empirically nor theoretically analyzed before.

Currently there are two related strands of research on the role of public capital spending in capital accumulation and economic growth. The first one focuses on the public capital spending and private investment nexus. In this research area, many studies found significant complementarity (crowding-in) effect, but some studies were either inconclusive or found contradictory results.[9] Blejer and Khan (1984) among others suggest that this ambiguity might be the result of using aggregate rather than disaggregate public investment, e.g. infrastructural public investment. The evidence for the Turkish economy is also ambiguous (see, for example, Anand *et al.*, 1990; Celasun and Tansel, 1993; Conway, 1990; Metin-Ozcan *et al*., 2001 and Uygur, 1995). The second approach analyzes the public capital spending and output (or growth) nexus. In this approach, the role of public capital spending, especially, public infrastructural investment, is theoretically considered both in a production function framework (e.g. Aschauer, 1989a) and in a new growth theory framework (e.g. Barro 1990). The empirical studies conducted in this area, using either a single-equation time series (Aschauer, 1989a) or a cross-section analysis (e.g. Easterly and Rebelo, 1993) has found a positive effect of public investment on growth.

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relative to current spending, particularly in the case of fiscal stringency. See Drazen (2000) and Persson and Tabellini (2000) for an overview.

[7] On the one hand, a rise in inflation rate usually rises the degree of dollarization and results in a loss of seigniorage revenue, by reducing the demand for domestic money. Furthermore, high inflation rate will also lower the revenues from ordinary taxes due to the Olivera-Tanzi effect. On the other hand, high indebtedness leads to a high debt repayment (principal plus interest payment) and lowers the overall public resources. See Agenor and Montiel (1996) for more details.

[8] See, for example, Sturm *et al.* (1998), Pereira (2000) and Mittnik and Neumann (2001).

[9] One of the earlier studies in the crowding-in, or more broadly, public capital spending-private investment nexus literature is the work of Blejer and Khan (1984); however, this literature has exploded with the seminal work of Aschauer (1989b). See Agenor and Montiel (1996) for an overview of earlier results.

Early studies on these two groups of literature were criticized on both the empirical and the theoretical grounds. For example, on theoretical grounds, production function approach is criticized for being inappropriate for analyzing the long run effects of public capital spending (Mittnik and Neumann, 2001). The main empirical criticisms are related to the reverse-causation, simultaneity, and "spuriousness" of the results (Munnel, 1992 Pereira, 2000 and Sturm *et al.* 1998). To overcome these empirical problems, recent studies used new time series techniques, such as multivariate cointegration and impulse response analyses (e.g., Ghali 1998; Pereira 2000; and Mittnik and Neumann 2001). These studies used variables such as private investment, public investment and output to analyze the effects of public capital spending on private capital spending and output; however, the issue of macroeconomic instability was not addressed. In this study our aim is to extend the recent literature to include the issue of macroeconomic instability. We consider the Turkish experience in our study, which we believe is a good case study, since Turkey has been suffering from chronic macroeconomic instability over the last twenty-five years. We are mainly interested in the empirical assessment of the effects of macroeconomic instability on public and private investment as well as in the nature of their relationships (i.e. complementarity) and economic growth. To accomplish this we estimate the long-run relationship between public investment, private investment, macroeconomic instability and output in Turkey for the period 1963-1999 by using multivariate cointegration analysis. The empirical analysis is also extended by considering the infrastructural component of public investment. Furthermore, the generalized impulse response functions are used to examine the dynamic effects of a shock on a given variable on all the other variables in the system.

This paper is organized as follows. Section 2 provides a condensed overview of the Turkish economy over the sample period (1963-99). Empirical results appear in Section 3 and finally Section 4 gives the conclusion and the policy implications of the findings.

2. AN OVERVIEW OF THE TURKISH ECONOMY, 1963-99

In this section, we will provide a condensed overview of the Turkish economy for the 1963-99 period. In line with the aims of this paper, we will mainly focus on capital formation, growth and macroeconomic instability.[10]

[10]See, for example, Aricanli and Rodrik (1990), Boratav *et al.* (1996), Celasun (1994), Celasun and Rodrik (1989) Ekinci (1990, 2000), Metin-Ozcan *et al.* (2001), Metin (1998), Ozatay (1997, 2000),

Table 1 provides summary information on the Turkish economy for the whole (1963-99) and two sub-periods, namely, inward-oriented period (1963-1979) and outward-oriented period (1980-1999). During 1963-1979 period, Turkey followed a state-led inward-oriented growth strategy by following import substitution policies and economy-wide planning by the State Planning Organization (SPO). Besides the trade restrictions and financial repression policies (e.g. regulated interest rates), the state made use of heavy public investment, especially in the manufacturing sector, to promote industrialization and economic development. During this period, Turkey enjoyed a high rate of growth (real GNP grew at an annual average rate of 5.1%) and a rapid rate of capital accumulation.[11] While real private investment[12] increased at an average annual rate of 7%, public investment increased at an average annual rate of 9.7%.

<INSERT TABLE 1 HERE>

During the 1960s the macroeconomic environment was quite stable.[13] However, mainly due to foreign exchange difficulties of the late 1960s, in 1970 Turkey introduced an IMF-based stabilization package, which involved a maxi devaluation. From 1973 to 1977, Turkey experienced an unprecedented growth in investment, led by public sector investment, mainly in manufacturing and transportation. Both public and private investment grew at high rates of 20.4% and 8.4%, respectively, during this period. However, macroeconomic instability significantly increased during the mid-70s mainly due to the deterioration of the fiscal balances and the excessive reliance on foreign borrowing. By the late 1970s Turkey reached a state where it could no longer service even the short-term debts and experienced severe economic crisis.

In 1980, Turkey took a crucial decision to switch its overall economic strategy from inward-oriented growth to outward-oriented growth. The 1980 program had both stabilization and

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Senses (1991) and Yeldan (1997) and references therein for more detailed analysis on related and other issues.

[11]It would be more appropriate to analyze inward-oriented period by considering two sub-periods, namely, economic crisis period (1978-79) and pre-crisis period (1963-77). The growth rate is more impressive when we look at the pre-crisis period (1963-1977) (real GNP grew at an annual average rate of 5.8%). Investment performance was also better for the pre-crisis period (1963-77), real private (public) investment grew, on average, by 9.3% (12.2%) per year.

[12]It should be noted that investment series have been revised several times in Turkey during the last two decades (See, for example, Conway (1990)). We reported our results in this section and elsewhere based upon the most recent series of the SPO (See the data appendix for more details).

[13]During the 1960s average inflation rate (INF) was only 5.2% compared to the 1970s (27%), the 1980s (50.4%) and the 1990s (73.2%). Furthermore, macroeconomic instability index (MII) was 0.04

structural aspects (e.g. trade and financial liberalization), and was strongly backed by IMF, World Bank and OECD consortium. The role of state has crucially changed with this program; for example, the state changed its investment strategy from manufacturing to infrastructure.

During the outward-oriented period of 1980-1999, real GNP of the Turkish economy grew at an average annual rate of 4.2%. Compared to the inward-oriented period, this performance doesn't seem impressive.[14] However, the economic growth rate was higher during the 1980s (5.2% per year) compared to the 1990s (3.2% per year). Private sector's capital formation performance was better compared to public sector's during the outward-oriented period. Real private (public) investment grew at an average annual rate of 6.1% (1.6%), from 1980 to 1999.[15] As we mentioned before, the crucial change in this period was the changing role of the state in the investment process. The share of core public infrastructural (transport + communication + energy) investment in total public investment rose from 37.3% in the inward-oriented period to 50.5% in the outward-oriented period. Nevertheless, while private investment-GNP ratio (in current prices) rose from 12.8% in the 1980s to 18.1% in the 1990s, public investment-GNP ratio dropped from 8.8% in the 1980s to 6.2% in the 1990s. The main reason behind this fall is the rising macroeconomic instability after the late 1980s, which has seriously lowered the fiscal "ability" of governments for making necessary investments, especially, infrastructural investments.[16]

Generally speaking, macroeconomic instability has steadily increased since the mid-1970s and has become a chronic problem for the Turkish economy.[17] During the early 1980s Turkey was successful in lowering the macroeconomic instability inherited from the economic crisis of the late 1970s. Inflation rate and MII fell from 89.6% and 0.520 points in 1980 to 26% and 0.317 points in 1983, respectively. Similarly, macroeconomic management was quite good during the mid-1980s. However, starting from the late 1980s macroeconomic instability has

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points and it was the lowest decade average compared to other decades (See the data appendix for more details on MII).

[14]Furthermore, real GNP fluctuated less during inward-oriented period compared to outward-oriented period.

[15]Note that as with real GNP, volatility of both public and private investment have increased during 1990s.

[16]In line with this argument, Conway (1990:82) stated that "[r]eal public investment growth appears to have [negatively] responded to budgetary pressures."

[17]Average annual inflation rate (INF) rose from 5.2% in the 1960s to 27% in the 1970s, 50.4% in the 1980s and 73.2% in the 1990s. Similarly macroeconomic instability index **(**MII) rose from 0.04 points in the 1960s, to 0.149 points in the 1970s, 0.436 points in the 1980s and 0.591 points in the 1990s.

risen, mainly due to the political factors and related populist and myopic policies,[18] and associated problems of public sector imbalances. Before the late 1993, Turkey had managed to maintain the populist policies mainly with the help of capital inflows.[19] However, the cost of this strategy was very high, real interest rate on domestic debt had increased steadily during early 1990s and this further deteriorated the fiscal balances, for instance, domestic interest payments out of consolidated budget (as % of GNP) almost doubled from 1990 to 1993.

Turkey experienced a very severe financial crisis in the early 1994 mainly due to unsustainable fiscal balances, the collapse of the domestic debt market, monetization and the expectations of further monetization. Real GNP contracted by 6.1% from 1993 to 1994, which is the peak rate of contraction of the Turkish economy over the 1963-1999 period. Similarly, real public investment fell dramatically by about 40%,[20] from 1993 to 1994. Real private investment, however, contracted only moderately (about 5%). Both inflation and MII peaked in 1994, inflation rate was 107.3% and MII was 0.842 points in 1994. Furthermore, Turkish Lira depreciated by more than 150% against US$ in 1994. In mid-1994, Turkey adopted an IMF-based stand-by agreement, and managed to cool-down the severe economic crisis. Inflation rate and MII fell from 107.3% and 0.842 points in 1994 to 87.2% and 0.563 points in 1995, respectively. However, macroeconomic instability has continued until the late 1990s, mainly due to reluctance of governments (e.g. to avoid negative political consequences) to take the necessary painful measures; in other words, governments delayed stabilization.[21] During this period, public sector balances were unsustainable due to reliance on the domestic borrowing (e.g. real interest rate on domestic debt almost doubled from 1994 to 1999). In December 1999, Turkey signed a three-year IMF-based stand-by agreement, which mainly aimed to solve the public sector imbalances.[22] Unfortunately, this program had failed in the early 2001 due to a major economic crisis and Turkey signed another program backed by IMF and the World Bank, which is still being implemented in Turkey.

[18]See, for example, Ozatay (1999), Akyurek (1999) and Onis (1997) for more detail and empirical evidence.
[19]Turkish Lira became fully convertible and capital account was fully-liberalized in 1989.
[20]This is a solid evidence of the negative effect of macroeconomic instability on fiscal "ability" of governments for making investment.
[21]See, for example, Veiga (2000) for well documented reasons for delayed stabilizations.
[22]See Ekinci (2000) and the references therein for a thorough overview of these problems and extensive assessment of the aspects of this program.

3. EMPIRICAL RESULTS

3.1. The Data and Unit Root Tests

The data used in this study are Turkish annual data from 1963 to 1999. The sample period is determined by the availability of official investment data. Figures 1-3 show the time plots of (LNY), (LNIP, LNIG, LNIGI) and (LNMII) respectively, where LNY is the (natural) logarithm of real GNP, LNIP is the logarithm of real private fixed investment, LNIG is the logarithm of real public fixed investment, LNIGI is the logarithm of real public fixed core infrastructural investment and LNMII is the logarithm of macroeconomic instability index (MII). The data appendix provides the details on the definitions and the sources of the data.

<INSERT FIGURES 1-3 HERE>

Visual inspection of the data suggests that all these series are I(1) (i.e. integrated of order one) or they have a unit root(s). However, we also provide the formal unit root test results in Table 2. As expected, for all the variables investigated none of them rejects the null hypothesis of I(1) at 95% critical level (See, the ADF test results in the second and third columns of Table 2). Furthermore, the null hypothesis of I(2) or existence of two unit roots rejected at 95% critical level for all variables (See, the ADF Test results on first differences in the fourth column of Table 2).[23] Therefore, all this evidence suggests that the variables under consideration can be considered as I(1). However, it is well-documented that if we neglect the level and/or the trend shift (e.g. due to a structural break) in the unit root tests, such as the ADF test, we could possibly obtain "spurious" unit root results (See, for example, Perron, 1989; and Franses, 1998; and the references therein). Therefore, since we know the break date quite well from the evidence reported in Section 2, which is 1980, we also performed a Perron test, which allows for a change in the level and trend. All variables except LNIG cannot reject the null hypothesis of a unit root at 95% critical level (See, the Perron Test results on the first differences in the last column of Table 2). However, LNIG cannot reject the null at 99% critical level.

In sum, all these results lend support to the maintained assumption that all these variables are I(1), which is a pre-condition for a cointegration analysis.

[23]Furthermore, the time plots of the first differences of all the variables (not reported in the paper but they can be requested from the first author) support these results.

<INSERT TABLE 2 HERE>

3.2. System Cointegration Analysis

This sub-section provides the system cointegration results. We provide results for total public investment and its infrastructural components. In line with this, we form two cointegration systems: System #1 [LNIP, LNY, LNIG, LNMII] and System #2 [LNIP, LNY, LNIGI, LNMII].

We use Johansen multivariate technique in our cointegration analyses (see Johansen, 1988 and Johansen, 1995). Following Doornik *et al.* (1998), Hendry and Juselius (2001) and Pesaran and Smith (1998), first we performed a cointegration analysis with constant term entering unrestrictively but the trend term is restricted to lie in the cointegration space. However, the trend term was found to be insignificant in the cointegration relation(s);[24] hence, following Hendry and Juselius (2001) we performed a cointegration analysis with the constant term entering unrestrictively but with no linear trends.

Following Juselius (2001) and Juselius and MacDonald (2000), we also included a step (intervention) dummy (DS80) in each cointegration system to account for the structural break of 1980. DS80 entered restrictively to the cointegration space. However, this step dummy is found to be insignificant in the cointegration relation.[25] This might be due to the reason that 1980 structural break could have affected several variables similarly[26] and hence causing the intervention effects to cancel out (see, Hendry and Juselius, 2001). Therefore, we did not include DS80 in our cointegration analysis.

Below, we present the cointegration analysis for the System #1 and System #2.

SYSTEM #1 [LNIP, LNY, LNIG, LNMII]

[24]Underlying trends of the variables under consideration possibly cancelled out in the cointegration relation (see Hendry and Juselius (2001)).
[25]Similarly, we also include a step dummy (DS89) in each cointegration system to account for the effect of the full-financial liberalization in 1989. This step dummy is also found to be insignificant in the cointegration relation.
[26]As can be seen from Figures 1-3, there is some visual evidence on this.

First we form the system with the variables [LNIP, LNY, LNIG, LNMII] and test for cointegration. Table 3 provides the cointegration result for System #1 with the lag length of the VAR = 1.[27] We also included an impulse dummy for 1994 (D94) unrestrictively in our cointegration analysis.[28] The trace and max statistics suggest one cointegration relation.[29] When we investigate Table 3, this cointegration relation seems to be the following simple long-run private investment relation:[30]

$$LNIP = 3.24\ LNY - 4.67\ LNMII - 0.29\ LNIG \qquad (1)$$

This equation suggests that private investment is positively affected by output, negatively affected by macroeconomic instability and public investment for the period under study. These results are consistent with theory and the descriptive analysis of the Turkish economy provided in Section 2. As it can be seen from standard errors of the cointegration vector in Table 3, all variables except LNIG are statistically significant. We also formally tested the significance of the variables by exclusion test. The results of these tests are confirmatory (Table 3). That is, LNY and LNMII have significant coefficients, but LNIG has insignificant coefficient. However, if we consider the cointegration result for System #1 without D94, we will have the following simple long-run private investment relation:

$$LNIP = 3.44\ LNY - 5\ LNMII - 0.38\ LNIG \qquad (2)$$

Both equations ((1) and (2)) are quite similar but when we examine standard errors (not reported) all variables seem to be significant. The result of significance (exclusion) test

[27]Note that the lag length of the VAR for each system is determined by Schwarz Bayesian Criterion.

[28]When we examine the regression results for each equation in VAR(1) model, LNIG equation has non-normal residuals. This is clearly evident in the residual plot of that equation in which 1994 is an outlying observation. (Note that this is consistent with the evidence in Section 2). Therefore, following Hendry and Juselius (2001), we include impulse dummy for 1994 (D94) in our cointegration analysis for System #1. After including D94 in VAR(1) unrestrictively, all equations have normal distributions and none of them show autocorrelation and heteroscedasticity (see Pesaran and Pesaran, 1997 for the details of these tests). Due to the same considerations we also include impulse dummy for 1994 (D94) in our cointegration analysis for System #2.

[29]It should be noted here that the trace and max statistics for System #1 without the impulse dummy (D94) also suggests one cointegration relation. Therefore, our results are not an artefact of dummy (D94).

[30]Note that we call this investment relation as simple investment relation since other determinants of investment, e.g. real interest rate, are absent in equation (1) (and the System #1) due to the purpose of the study, or data availability and/or limitations of cointegrated VAR analysis with relatively small sample size (see Pesaran and Pesaran, 1997 for more detail).

provides a p-value of 0.059 for LNIG (LNY and LNMII both have p-value=0); therefore, there is some (but marginal)[31] evidence of long-run crowding-out effect.

<INSERT TABLE 3 HERE>

SYSTEM #2 [LNIP, LNY, LNIGI, LNMII]

We now would like to examine the effect of the infrastructural component of the public investment. Therefore, only difference of System #2 compared with the System #1 is that we have replaced LNIG with LNIGI. Table 4 provides the cointegration results for the System #2 with lag length of VAR = 1.[32] The evidence favors one cointegration relation and it is also interpreted as private investment relation (See Table 4). The crucially different result in this system is that even though LNIGI has negative effect (crowding-out) on LNIP, its coefficient is not significant as indicated by the long-run exclusion test in Table 4. Furthermore, this is also the case without D94.[33] After imposing the long-run exclusion restriction (and the normalization restriction), the investment relation becomes:

$$LNIP = 3.15LNY - 5.20\ LNMII \qquad (3)$$

This simple investment equation suggests that private investment is positively affected by output and negatively affected by macroeconomic instability. Again, these results are consistent with theory and the descriptive analysis of the Turkish economy provided in Section 2.

<INSERT TABLE 4 HERE>

Finally, we would like to note that our main results in this section also hold when we use inflation rate as a proxy[34] for macroeconomic instability. This is provided in Ismihan (2003). In the next section, in order to get more insights, we examine the dynamic effects of a shock on a given variable on all the other variables in the system, by using impulse response analysis. (See, for instance, Lutkepohl and Reimers (1992) and Pesaran and Pesaran (1997) for the importance of impulse response analysis in cointegrated systems).

[31]At 5.9% significance level.
[32]Due to the similar considerations D94 enters unrestrictively to the cointegration analysis.
[33]Note that, in System #2 without D94, the private investment relation becomes: LNIP = 3.21 LNY – 0.23 LNIGI – 4.45 LNMII. Furthermore, all variables are significant except LNIGI (p-value = 0.11).

3.3. Impulse Response Analysis

In this section, we provide the generalized impulse response (IR) functions[35] to examine the dynamic effects, that is, short and medium-run effects of a shock on a given variable on all the other variables in the system. Below, we present this analysis for the System #1 only since the impulse response analysis of System #2 is quite similar to that of System #1.[36]

In order to assess the dynamic effects of macroeconomic instability on other variables in the system, we examine the generalized IRs to a positive unit [one standard error (S.E.)] shock in macroeconomic instability (LNMII) equation. These generalized IRs are provided in panel (a) of Figure 4. As expected, short and medium-run responses are negative. That is, private investment, public investment and output are negatively and permanently affected by a positive shock in macroeconomic instability. However, private investment was dramatically affected compared to output, which is the least affected one. Furthermore, public investment is also seriously affected from macroeconomic instability shock. As we mentioned in Section 1, this is probably due to a negative effect of macroeconomic instability shock on the fiscal "ability" of the governments to spend on public investment. Furthermore, governments tend to cut public investment rather than current (or populist) spending in the case of fiscal stringency due to political factors, as suggested by the recent new political economy literature. All these results are consistent with our analysis in Section 2. Finally, as can be seen from panel (a) of Figure 4, impact effects of macroeconomic instability shock on both private and public investments are smaller compared to the medium-term effects; that is, the effect of a macroeconomic instability shock has an accelerating negative effect on investment, especially, on private investment.

<INSERT FIGURE 4 HERE>

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[34]According to Fischer (1993b:487), inflation rate is the best single indicator [of policy-induced macroeconomic instability] and "serve as an overall ability of government to manage the economy".

[35]We prefer to use generalized IR functions since, unlike to the orthogonalized IR functions, the generalized IR functions do not depend on the ordering of the variables within the system (Pesaran and Shin, 1998).

[36]There is only one considerable difference. In the System #2, public infrastructural investment is more seriously affected from macroeconomic instability (shock) compared to total public investment in the System #1. This is consistent with the observation that Turkey failed to make necessary infrastructural investment due to fiscal problems and restraints during the late 1990s, and hence experienced infrastructural bottlenecks, such as energy bottlenecks, during the late 1990s and the early 2000s. The results of generalized IR analysis for the System #2 can be requested from the first author.

We next examine the dynamic effects of public investment shock on other variables in the cointegration system. As can be seen from the panel (b) of Figure 4, responses of private investment and output are positive; however, the response of the former is much larger. These results suggest a complementarity between public and private investment in the short and the medium-run. Note that, public and private investment moved or "wandered" together, implying complementarity, until the late 1970s (see Figure 2) but after the late 1970s this relationship started to shatter possibly due to a negative effect of chronic macroeconomic instability on both private and public investment but via different channels, as we mentioned in Section 1. Furthermore, this relationship seems to be reversed after the late 1980s, possibly due to rising macroeconomic instability and associated deterioration in fiscal balances, which has affected both public and private investment. Therefore, in the case of Turkey, chronic and increasing macroeconomic instability and associated fiscal problems seems to shatter or even reverse the complementarity between public and private investment in the long-run. This observation is in line with the recent work by Metin-Ozcan *et al.* (2001).

Furthermore, response of macroeconomic instability to public investment shock is initially negative but over the medium-term it diminishes towards zero. This result suggests that the rise in public investment does not contribute to the macroeconomic instability over the short and the medium-term. One potential explanation for this seemingly counterintuitive result is that an increase in public investment in case of chronic macroeconomic instability and associated fiscal stringency signals a decisive change in fiscal policy, e.g. from populist to productive spending, and could have immediate political credibility and expectation effects which will lower expected inflation, inflation risk on borrowing, and hence macroeconomic instability (See, for example, Alesina *et al.* (1998) and Perotti (1999) and the references therein for similar arguments).[37] Furthermore, the rise in public investment increases expenditures of government but the rise in public investment also increases national income and output due to its dual role; that is, public (and also private) investment affects both demand and supply-side of the economy. The rise in national income will, in turn, increase the revenues of government, e.g. tax and seigniorage revenue, and help to reduce the fiscal deficit and, therefore, inflation over some period, but with diminishing effects.

Finally, we examine the dynamic effects of a positive unit shock to output on all the other variables. As panel (c) of Figure 4 reveals, the short and the medium-run responses of private investment to a rise in output is positive as expected. Similarly, the response of public

[37] According to Perotti (1999:1400), "… in times of fiscal stress the economy's response to fiscal shocks changes qualitatively."

investment is also positive. Furthermore, as can be seen from panel (c) of Figure 4, impact effects of output shock on both private and public investment are only slightly different than medium-term effects. Moreover, short-run responses of macroeconomic instability is negative (e.g. due to the positive effect on revenues of government and, therefore, inflation); however over the medium term this response approaches towards zero.[38]

4. CONCLUSION AND POLICY IMPLICATIONS

This study investigated the empirical relationships between macroeconomic instability, capital accumulation and growth in Turkey over the period 1963-1999. The main conclusion is that the chronic macroeconomic instability of the Turkish economy has seriously affected the capital formation and growth. Even though we found some evidence of crowding-out effect of total public investment on private investment, there was no significant effect of public infrastructural investment on private investment in the long-run. However, we found some evidence of complementarity between private and public investment over the short and medium-run. Our results suggest that the chronic macroeconomic instability seems to become a serious impediment to the public investment, and has shattered, or even reversed, the long-run complementarity. This result may also shed some light on the ambiguity concerning the empirical evidence on complementarity (crowding-in) effect for the Turkish economy.

The policy implications are straightforward when we consider these results. Generally speaking, over the last twenty five years, governments in Turkey either delayed or did not continue with the stabilization programs. The barriers to stabilization, such as political instability and polarization, are well-documented in Veiga (2000) and Drazen (2000) among others. Nevertheless, as this study shows, macroeconomic instability has an adverse impact on capital accumulation and economic growth in Turkey. Therefore, the government should continue the current stabilization program to restore macroeconomic stability, as soon as possible. This is the first policy implication. The second policy implication is that policy makers have to be careful in their decisions concerning the components of public spending that would bear the burden of fiscal adjustment. If government reduces public capital spending (especially, infrastructural spending) instead of current and populist spending; then,

[38]The dynamic effects of private investment shock are similar to public investment shock on all the other variables (simply replace LNIP with LNIG in panel (b) of Figure 4); therefore, it is not separately explained.

this would harm capital accumulation, economic growth and development.[39] Furthermore, as opposed to the conventional view that fiscal adjustments are recessionary, there is growing evidence that some types of fiscal adjustments may be expansionary (Perotti, 1996, 1999; and Alesina *et al.*,1998). This new line of research argues that composition of adjustment matters. For example, fiscal adjustments based on current spending may be expansionary under certain conditions, such as initial conditions like very high level of debt to GNP ratio (Perotti, 1999).

In sum, Turkish experience has shown that macroeconomic instability not only deters economic growth but it may also reverse the complementarity between public and private investment in the long-run. In order to shed more light on this result, this study can be further extended to other developing countries suffering from chronic instability like Turkey and this is left for future research.

DATA APPENDIX

LNY is the (natural) logarithm of real GNP in 1994 prices (billion TL).
Source: SPO (1997) and SPO (2001).

LNIP is the (natural) logarithm of real private fixed investments in 1994 prices (billion TL). Nominal private fixed investment series were deflated by private fixed investment deflator series.
Source: SPO (1997) and SPO (2001). Note: deflators were provided by the SPO.

LNIG is the (natural) logarithm of real public fixed investments in 1994 prices (billion TL). Nominal public fixed investment series were deflated by public fixed investment deflator series.
Source: SPO (1997) and SPO (2001). Note: deflators were provided by the SPO.

LNIGI is the (natural) logarithm of real public fixed core infrastructural investments in 1994 prices (billion TL). Nominal sectoral public fixed investment series were deflated by relevant sectoral public fixed investment deflator series. In line with Ekinci (1990) and Boratav *et al.*

[39]See, for example, World Bank (1994) and the references therein, for the crucial importance and the multi-dimensional roles of infrastructure in economic development.

(1996) we define core infrastructural investment as the total of the public energy, transportation and communication sectors' fixed investments. See World Bank (1994:2) for broad definition of infrastructure.
Source: SPO (1997) and SPO (2001). Note: Sectoral deflators were provided by the SPO.

LNMII is the (natural) logarithm of the macroeconomic instability index (MII), i.e., LNMII = ln (1+MII). This index is calculated by using human development index (HDI) methodology and it is based on macroeconomic instability indicators, such as inflation rate, deficit to GNP ratio, external debt to GNP ratio and change in exchange rate, identified by previous researchers (e.g. Fischer, 1993a,1993b; and Bleaney, 1996). It is a simple average of the four sub-indices obtained from these four variables. We use this index (MII) as a proxy for macroeconomic instability.
Source: Ismihan (2002).

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Table 1. Selected Indicators of the Turkish Economy

	1963-99	1963-79	1980-99
I. Output and Capital Formation			
I.A Annual Average Growth Rate			
Real GNP (Y)	4.4	5.1	4.2
Real Private Fixed Investment (IP)	5.8	7.0	6.1
Real Public Fixed Investment (IG)	5.0	9.7	1.6
Real Public Fixed Core Infrastructural Investment (IGI)	5.9	10.8	2.7
Real Public Fixed Non-Core Infrastructural Investment	4.3	26.5	0.8
I.B Composition of Public Investment*			
Core Infrastructural Investment (as % of total)	44.4	37.3	50.5
Non-Core Infrastructural Investment (as % of total)	55.6	62.7	49.5
II. Macroeconomic Instability*			
Macroeconomic Instability Index (MII)	0.326	0.104	0.514
Inflation Rate (INF), %**	41.7	18.1	61.8

* Simple period average.

** INF=Percentage change in GNP Deflator.

Source: See the data appendix

Table 2. Unit Root Tests

Variables	ADF Test			Perron Test
	Level		First Difference	Innovation Outlier (IO)
	Without Trend[a]	With Trend[b]	Without Trend[a]	Model[f]
LNY	-1.0696 (0)[c]	-2.4769 (0)	-4.9665 (0)*[d]	-2.6439(0)[h]
LNIP	-1.2921 (1)	-3.0168 (3)	-3.3808 (0)*	-2.0148(1)
LNIG	-2.2886 (3)	-2.4310 (1)	-4.5756 (0)*	-4.4852(2)[g]
LNIGI	-1.9448 (0)	-1.8378 (0)	-4.4798 (1)*	-3.8352(1)
LNMII	-1.2578 (1)	-----[e]	-8.0355 (0)*	-----[e]

[a]ADF regressions include an intercept but not a linear trend (See, Pesaran and Pesaran, 1997:53).

[b]ADF regressions include both an intercept and a linear trend (See, Pesaran and Pesaran, 1997:53).

[c]Numbers in parentheses are the order of augmentations (p*) chosen by the Akaike Information Criterion (AIC). Note that unit root test results also hold when p*(s) are chosen by Schwarz Bayesian Criterion (SBC). Due to a size-power trade-off in the determination of the order of augmentation (p) of ADF tests, we choose to select p* by AIC, which is a common practice in the applied works (see, Pesaran and Pesaran, 1997:213). Therefore, in line with Pesaran and Pesaran (1997:213), first we estimated ADF regressions for p=0 to p=4 and selected the order of augmentation (p*) based on AIC. Then, we performed the ADF tests (see the text). Note that the same sample period (1969-1999) is used in calculations.

[d]An asterisk (*) represents the rejection of the unit root null hypothesis at 95% critical level (MacKinnon, 1991:Table 1)

[e] Since MII is bounded between 0 and 1 due to its construction (see the data appendix), we did not include trend for LNMII (see, for example, Ahmet and Rogers (2000)). Furthermore, linear trend in LNMII is not meaningful from the economic point of view.

[f]This model is within innovation outlier (IO) framework and allows for both a change in the level and trend (See, Franses (1998:150-1) for this test).

[g]LNIG rejects the null hypothesis at 95% critical level but not at 99% level (see Franses (1998, Table 6.6) for critical values).

[h]Numbers in parentheses are the order of augmentations (p*) chosen by the Akaike Information Criterion (AIC). Note that test results also hold when p*(s) are chosen by Schwarz Bayesian Criterion (SBC) or if we just use the same p*(s) of the third column. We use the same procedure as in note (c) for determining the order of augmentation (p*). Note that the same sample period (1969-1999) is used in calculations.

Table 3. Cointegration Analysis of System #1

Eigenvalues	0.60355	0.21840	0.12638	0.03471
Null Hypotheses	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Max Statistic	33.31	8.87	4.86	1.27
95% Critical Value[a]	27.07	20.97	14.07	3.76
Trace Statistic	48.31	15.0	6.13	1.27
95% Critical Value[a]	47.21	29.68	15.41	3.76

Cointegration Results (r=1)

	LNIP	LNY	LNMII	LNIG
(β')[b]	1	-3.2364 (0.48324)[c]	4.6669 (1.2104)	0.289 (0.18182)
(α')[d]	-0.0919	0.0161	-0.1449	-0.0280

Hypotheses Tests	$X^2(u)$	u	p-value
Test of significance[e] of LNY	17.3	1	0.00
Test of significance of LNMII	24.3	1	0.00
Test of significance of LNIG	2.2	1	0.14

[a]Critical values are from Osterwald-Lenum (1992, Table 1)
[b]Standardized eigenvector.
[c]Asymptotic standard errors are in parentheses.
[d]Adjustment coefficients.
[e]Test of long-run exclusion (See, Hendry and Juselius, 2001).

Table 4. Cointegration Analysis of System #2

Eigenvalues	0.638	0.17509	0.10778	0.042736
Null Hypotheses	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Max Statistic	36.68	6.93	4.11	1.57
95% Critical Value[a]	27.07	20.97	14.07	3.76
Trace Statistic	49.19	12.61	5.68	1.57
95% Critical Value[a]	47.21	29.68	15.41	3.76

Cointegration Results (r=1)

	LNIP	LNY	LNMII	LNIGI
(β')[b]	1	-3.1551	4.3892	0.20909
		(0.39148)[c]	(1.0593)	(0.12639)
(α')[d]	-0.0905	0.0185	-0.1499	-0.1393

Hypotheses Tests	**X^2(u)**	**u**	**p-value**
Test of significance[e] of LNY	17.7	1	0.00
Test of significance of LNMII	29.5	1	0.00
Test of significance of LNIGI	2	1	0.16

Restricted Cointegration Analysis

	LNIP	LNY	LNMII
(β')[b]	1	-3.1539	5.2016
		(0.50615)[c]	(1.4605)
(α')[d]	-0.0548	0.0198	-0.1290

[a]Critical values are from Osterwald-Lenum (1992, Table 1)
[b]Standardized eigenvector.
[c]Asymptotic standard errors are in parentheses.
[d]Adjustment coefficients.
[e]Test of long-run exclusion (See, Hendry and Juselius, 2001).

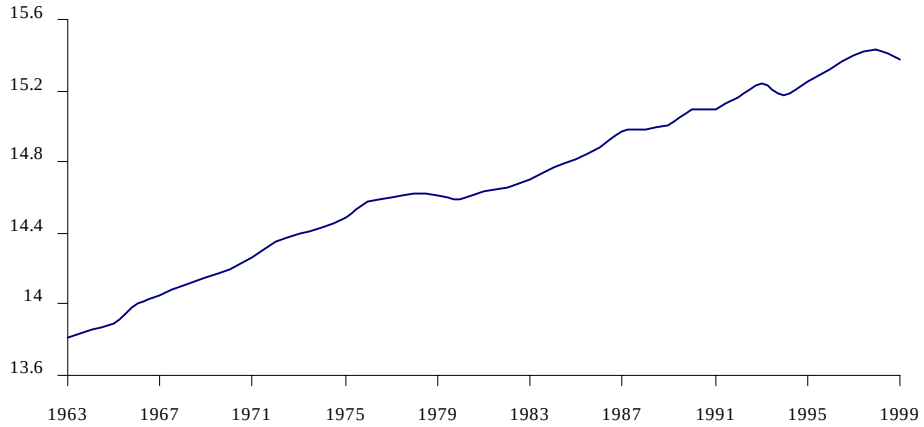


Figure 1. Time Plot of LNY

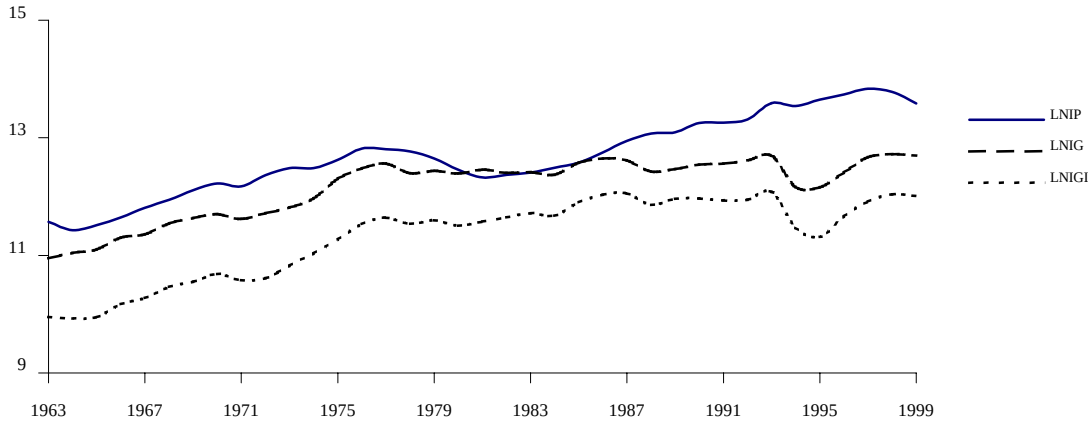


Figure 2. Time Plot of LNIP, LNIG and LNIGI

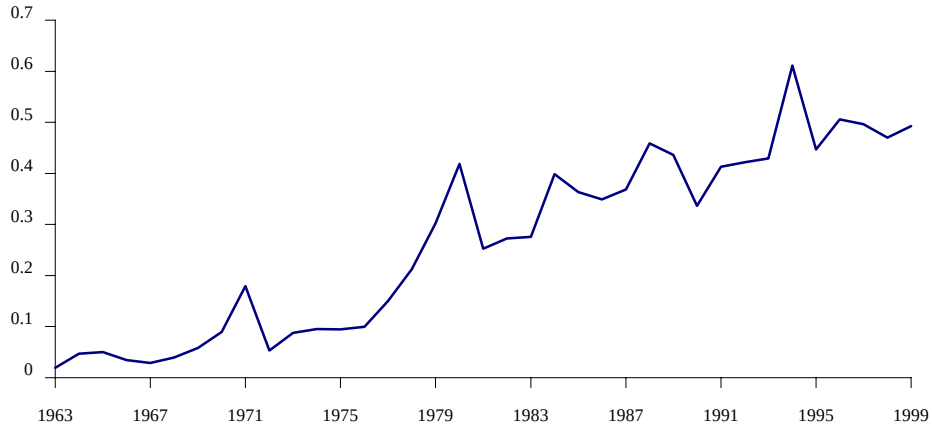
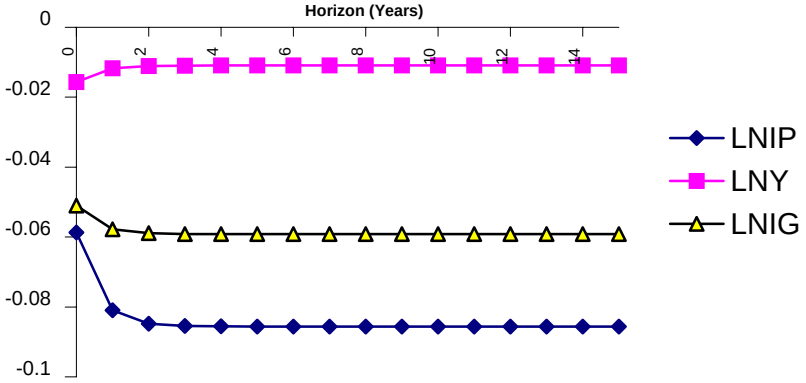
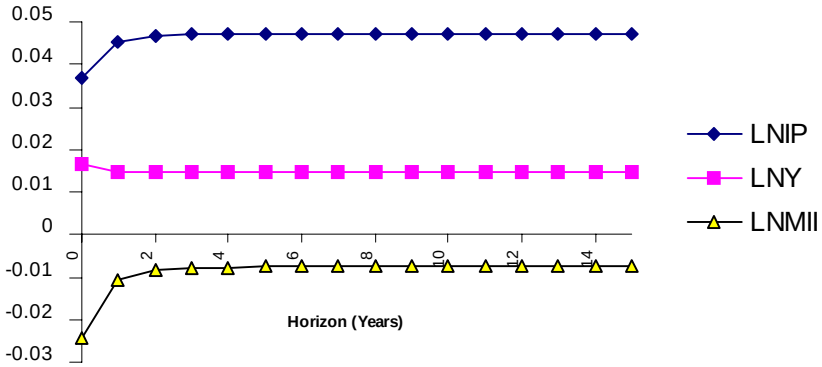


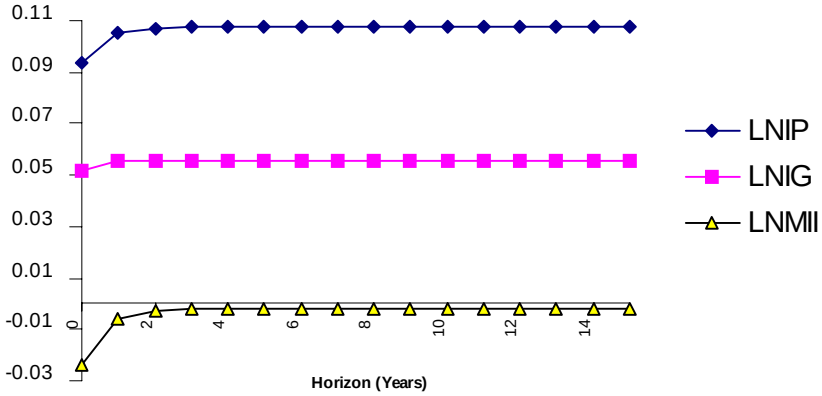
Figure 3. Time Plot of LNMII



(a) Generalized IR(s) to one S.E. shock in the equation for LNMII



(b) Generalized IR(s) to one S.E. shock in the equation for LNIG



(c) Generalized IR(s) to one S.E. shock in the equation for LNY

Figure 4. Generalized IR(s) to one S.E. shock in the equation for LNMII, LNIG, LNY