

MACROECONOMIC PERFORMANCE, PUBLIC INVESTMENT AND GROWTH: AN EMPIRICAL ANALYSIS

Dr. Alpaslan Akçoraođlu

Faculty of Economic and Administrative Sciences
Gazi University

•••

*Makroekonomik Performans, Kamu Yatırımları ve İktisadi Büyüme:
Bir Ampirik Analiz*

Özet

Bu çalışma, modern zaman serileri analizini kullanarak, Türkiye ekonomisi bakımından makroekonomik faktörlerin iktisadi büyüme üzerindeki rolünü araştırmaktadır. Ampirik bulgularımız, makroekonomik istikrarın sürdürülebilir iktisadi büyümeye katkıda bulunduğunu göstermektedir. İktisadi büyüme; yüksek enflasyon, büyük bütçe açıkları ve döviz kuru piyasasındaki sapmalar ile negatif bir korelasyon içerisindedir. Diğer yandan, sermaye birikimi ve özellikle de özel sermaye birikimi, Türkiyenin iktisadi büyümesinde çok önemli rol oynamışlardır. Sürdürülebilir iktisadi büyüme bakımından olumsuz kurumsal yapılar ve siyasal unsurlara karşın, temel olarak kamu yatırımlarının kısılmasına yönelik, kamu açıklarının azaltılması politikaları, sermaye birikimini ve büyümeyi olumsuz yönde etkileyebilecektir. Ayrıca, bulgularımız kamu yatırımlarının, özel yatırım imkanlarını daralttığı şeklindeki görüş ile tutarlılık göstermemektedir.

Abstract

This paper analyzed the role of macroeconomic performance on economic growth by means of general methodology of time series analysis, using annual data from Turkish economy. The empirical evidence presented in this paper suggests that macroeconomic stability is conducive to sustainable economic growth. Economic growth is negatively correlated with high inflation, large public deficits, and distortions in foreign exchange market. On the other hand, the results indicate that capital accumulation (especially private capital formation) has played a prominent role in the economic development of Turkey in the past decades. Despite institutions and political factors unfavorable to sustainable economic growth, deficit reductions that rely mainly on public investment cuts could negatively influence capital accumulation and growth. Moreover, our findings are not consistent with the view suggesting that public investment has often reduced the possibilities for private investment.

Macroeconomic Performance, Public Investment and Growth: An Empirical Analysis*

I. Introduction

Recent contributions have indicated that a stable macroeconomic framework is conducive to sustainable economic growth. It has been argued that the fast growing countries of East Asia have generally maintained single or low double-digit inflation, and have for the most part avoided large budget deficits. In Latin America, the recovery of economic growth was generally preceded by the restoration of macroeconomic stability. However, the notion that macroeconomic stability is not sufficient for growth is supported by evidence from most of the countries of the franc zone in Africa (FISCHER,1993). This paper analyzes the role of macroeconomic factors on growth for the specific case of Turkey. By employing modern time series analysis, this paper investigate empirical regularities between some proxies of macroeconomic stability and economic growth.

The role that the government should play in the economic growth of a country has been a largely controversial issue in economics. New classical view suggests that public investment undertaken by heavily subsidized and inefficient state-owned enterprises in various sectors of the economy has often reduced the possibilities for private investment and long run economic growth. Furthermore, the financing of public investment through external and internal indebtedness and the repression of the private financial system have crowded out the private sector from profitable investment opportunities. For these reasons, many developing countries have changed their overall development strategies. Since public expenditures were considered to be the main source of

* The author would like to thank anonymous referee for helpful comments and suggestions.

external and internal debt, IMF- sponsored stabilization programs have, among other things, drawn upon governments to cut their spending on public investment.

On the other hand, some schools of economic thought (especially neo-Keynesians) believe that public investment is of critical importance, not only as a component of final aggregate demand, but also in terms of the impact of public investment on the economy's growth and employment opportunities. In addition, developing countries are generally characterized by the existence of monopolies and the lack of fully developed markets of capital and information. Therefore, public investment can make product and factor markets work more efficiently and, hence, generate substantial spill-over effects for the private sector.

This paper also analyzes the statistical association between public investment, private capital formation and the level of economic development using general methodology of time series. The rest of the paper is organized as follows. Section II outlines the theoretical arguments. Section III summarizes data and econometric methodology. Section IV presents the empirical results and Section V contains the conclusion.

II. Theoretical Background

It is not easy to quantify the degree of macroeconomic stability in a country. Fischer (1993) selects some indicators that could be utilized as proxies of macroeconomic stability. The basic indicators of macroeconomic stability are the inflation rate, the budget deficit or surplus, and distortions in foreign exchange market. According to Fischer's analysis, the inflation rate is the best single indicator of the conduciveness of macroeconomic policies to growth and the budget deficit (or surplus) as the second basic indicator. Inflation can be seen as an indicator of the overall ability of the government to manage the economy. In other words, a government that is producing high inflation is a government that has lost control.

Inflation may have a negative impact on economic growth by means of reducing the rate of return of investment and thus the accumulation of the capital stock (BRUNO, 1993). Moreover, it also diminishes inputs productivity by distorting price signals, hence, reducing the efficiency in the allocation of resources. In case of the inflation that arises as consequence of the monetization of the public deficits, inflation has been compared to a distorting tax. In the specific case of a country under a fixed exchange rate system, it may entail a reallocation of resources from the tradables to the nontradables sectors, where productivity growth is lower. Finally, a high inflation rate may be a symptom of a lack of commitment or little success of the monetary authority in the

maintenance of macroeconomic stability. Some recent empirical studies show a negative correlation of inflation and economic growth (FISCHER, 1993; BARRO, 1995).

A large budget deficit can easily bring about high rates of inflation or high interest rates (in order to be able to obtain debt finance) which will affect negatively private investment and economic growth (BARTH/BRADLEY, 1989). Barro (1990) asserts that a large value of public deficit will crowd out private activity and reduce growth. Cebula (1995) reports a negative statistical association of public deficits and economic growth for the case of the United States.

The black market premium on foreign exchange is an indicator of the sustainability and appropriateness of the exchange rate. Distortions in foreign exchange market may be linked to economic growth in the following two ways. First, black market premium can be seen as an easily quantifiable proxy of distortions in markets in general. In the framework of endogenous growth models, the distortions in markets can affect the rate of economic growth (ROMER, 1990). On the other hand, the disparities in per capita growth among various countries may stem from the differences in economic policy and institutions, that in turn shape the structure of incentives that prevails in each society (OLSON, 1996). Therefore, the presence of distortions in markets may undermine economic growth in developing countries. Easterly (1993) presents some empirical evidence in favor of the negative correlation between distortions and economic growth. Second, an increase in the black market premium is an indicator of expectations of depreciation of the exchange rate and foreign exchange rationing. This suggests that economic growth, capital accumulation and black market premium are likely to be negatively related, since foreign exchange rationing will have a negative impact on intermediate goods imports, one of the ways of technological catch-up for developing countries.

Since different categories of public spending have diverse economic effects, we should investigate the nexus between disaggregated categories of public expenditure and growth. Barro and Sala-i-Martin (1995), Barro (1991), and Easterly and Rebelo (1993), for example, show that public expenditure categories that promote human or physical capital accumulation are positively associated with growth, while public consumption appears to have negative or neutral effect. Since capital accumulation is the engine of economic growth, any crowding-out effects of private investment by public expenditures impinge upon production expansion and welfare prospects. Aschauer (1989) concludes that the direct crowding-out effect of public investment is outweighed by an indirect crowding-in effect associated with the role of public capital as a productive input and its complementarity to private capital. As to the impact of public consumption, it has been argued that its crowding-out effect on private

investment carries only a marginal explanatory power (ASCHAUER, 1989; DE LONG/SUMMERS, 1992; BARRO/SALA-I-MARTIN, 1995). That result could be interpreted as an indication that public consumption is a close substitute for private consumption. However, Karras (1994) claims that private and public consumption are best described as complementary (or unrelated) goods. Empirical evidence presented by Karras (1994) supports the crowding-out effect of private investment and is consistent with the empirical findings of Barro (1991) who indicates a negative association of government consumption with private investment.

On the other hand, some recent studies by political economists argue that institutional and political factors such as widespread corruption, poorly functioning state, mafia-like groups, and the lack of rule of law may undermine economic growth in developing countries (ALESINA, 1997). This view concludes that institutions are important for growth. Therefore, increasing emphasis is being placed on creating institutional structures favorable to economic development.

III. Data and Empirical Methodology

In order to test empirically the association between macroeconomic performance, public investment and growth, a time series analysis comprising annual data for Turkey, from the period 1965-95, has been carried out. Data used in this study are obtained from "Statistical Indicators (1923-1995)" published by State Institute of Statistics (DİE). In addition, several issues of *Picks Currency Yearbook* and *World Currency Yearbook* have been utilized for the data of market (or black market) exchange rate¹. The exchange rate black market premium is defined as the difference between black market exchange rate and official exchange rate. Data for black market exchange rate were only available for the 1960-1985 period.

The variables in this paper, where \ln denotes the natural logarithm of the variable, are the following (All the nominal variables were deflated by wholesale price index (1963=100) in order to construct real variables).

PCY: (real) per capita GNP,	GC: Real Public Consumption
LPCY: \ln (PCY),	IP : Real Private Investment
INF: Inflation Rate	IG : Real Public Investment
LBMP: \ln (BMP),	BMP: Exchange Rate Black Market Premium

1 Black market exchange rate of TL/US Dollar have been utilized. It is evident that this variable is relevant especially for the period of fixed exchange rate system until 1980 for the case of Turkey.

BD: Real Budget Deficit (Nominal budget deficit is defined as the difference between nominal public spending and nominal public revenues. Nominal budget deficit was deflated by wholesale price index (1963=100) in order to obtain real budget deficit).

LBD: $\ln(\text{BD})$

The Johansen and Juselius (1990) multivariate cointegration analysis allows us to estimate the long-run or cointegrating relationships between the non-stationary variables using a maximum likelihood procedure, which tests for the cointegrating rank and estimates the parameters of these cointegrating relationships.

The cointegration methodology pioneered by Hendry (1986) and Engle and Granger (1987) opened a new channel toward testing for Granger-causality. As Granger pointed out, if two variables are cointegrated then Granger-causality must exist in at least one direction. This result is a consequence of the relationships described by the error-correction model. Traditional inference procedures cannot be used if the data present unit roots, since t-statistic are biased and inconsistent. The Three Step procedure of Engle and Yoo (1991), however, eliminates this problem.

IV. Empirical Results

The test results for unit roots are reported in Table 1. The results of augmented Dickey-Fuller (ADF) and the Phillips and Perron (PP) tests imply that the null hypothesis of I(1) process cannot be rejected in all cases. In each case the lag length is chosen by minimizing Schwarz Criterion (SC).

Table 1. Test results for unit roots

Variable	k	ADF	ADF(trend)	1	PP
PCY	0	-0.162	-2.187	3	-0.038
LPCY	0	-1.343	-1.977	3	-1.385
IP	1	2.423	0.733	3	1.302
IG	0	-2.119	-1.784	3	-2.133
GC	2	-0.724	-2.292	3	-0.157
LBD	2	-2.340	-2.911	3	-2.256
INF	0	-1.537	-2.850	3	-1.302

LBMP	1	-0.311	-2.031	3	-1.044
Δ PCY	0	-7.106**	-7.054**	3	-7.090**
Δ LPCY	0	-6.040**	-6.008**	3	-6.037**
Δ IP	0	-6.002**	-6.886**	3	-6.035**
Δ IG	0	-4.482**	-4.512**	3	-4.365**
Δ GC	4	-3.344**	-3.377*	3	-5.387**
Δ LBD	1	-9.144**	-9.040**	3	-19.70**
Δ INF	0	-7.022**	-7.080**	3	-7.292**
Δ LMBP	0	-6.816**	-6.623**	3	-7.427**
5 % critical value:		-2.938	-3.528	-2.938	
10 % critical value:		-2.607	-3.195	-2.607	

NOTES: represents first differences. k is optimal lag length chosen by Schwarz Criteria (SC). l is a truncated lag parameter used in Phillips-Perron test and is set to three as suggested by Newey and West (1987). ** indicates significance at 5 % level and * indicates significance at 10 % level.

The results for testing for the number of cointegrating vectors by Johansen procedure are reported in Table 2, which presents both the maximum eigenvalue (max) and the trace statistics, as well as the corresponding 5 % critical values.

Table 2. Johansen tests for cointegration

Panel 2a. Variables examined PCY and IP

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	11.38	15.41	10.27	14.10
$r \leq 1$		1.112	3.760	1.112	3.760

Panel 2b. Variables examined PCY and IG

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	4.872	15.41	4.862	14.10
$r \leq 1$		0.010	3.760	0.010	3.760

Panel 2c. Variables examined PCY and GC

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	8.397	15.41	6.899	14.10
$r \leq 1$		1.498	3.760	1.498	3.760

Panel 2d. Variables examined IP and IG

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	6.423	15.41	5.293	14.10
$r \leq 1$		1.130	3.760	1.130	3.760

Panel 2e. Variables examined LPCY and LBD

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	33.48*	15.41	30.72*	14.10
$r \leq 1$		2.760	3.760	2.760	3.760

Panel 2f. Variables examined PCY and INF

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	19.15*	15.41	19.11*	14.10
$r \leq 1$		0.039	3.760	0.039	3.760

Panel 2g. Variables examined LPCY and LBMP

H_0	k	Trace statistic	95 % critical value	λ max test	95 % critical value
$r = 0$	1	7.730	15.41	5.464	14.10
$r \leq 1$		2.266	3.760	2.266	3.760

NOTES: * denotes that a test statistic is significant at the 5 % level. k represents optimal lag length chosen by Schwarz Criteria (SC).

The evidence reported in Table 2 reveals a long-run cointegrating relationship between inflation and economic growth. In addition, The results in Table 2 support the existence of cointegrating relationship between budget deficit and economic growth. However, test results in Table 2 lead us to

conclude that a long-run equilibrium relationship between other macroeconomic variables (i.e., private investment, public investment, public consumption, and black market premium) and economic growth does not exist over this time period.

Without evidence of cointegration, an error-correction procedure to model short-run dynamics is not available to us. Nevertheless, it may still be possible to model short-run behaviour of the system using standard testing procedures of causality. On the other hand, the tests are carried out using the first differences of each series (i.e., the stationary values). The results of Wald-F tests for Granger-causality are presented in Table 3. Using Schwarz Criterion (SC) for lag specification, column two show lag length chosen for the dependent and independent variables respectively. Since long-run relationships have been detected in two cases, we utilized a dynamic error-correction model (ECM) of these relationships. The generated Wald-F test results are reported in column three and show conclusions concerning the direction of causality.

Table 3. Tests for Granger causality and estimated error correction terms

Causality from	To ^d	<i>k</i>	F-statistic	Estimated coefficients of EC terms	Causal inferred
IP	PCY	(1,1)	4.394 (4.23) ^c	-	IP PCY
IG	PCY	(8,8)	6.963 (4.82) ^c	-	IG PCY
GC	PCY	(1,1)	1.034 (4.24) ^c	-	No causality
IG	IP	(1,1)	1.707 (4.24) ^c	-	No causality
LBD [§]	LPCY	(1,1)	7.378 (4.17) ^c	-0.0704 (-1.856) ^{*,*}	LBD LPCY
INF [§]	PCY	(1,1)	4.252 (4.17) ^c	-0.3372 (-2.529) ^{*,*}	INF PCY
LBMP [¶]	LPCY	(2,2)	4.076 (3.56) ^c	-	LBMP LPCY

NOTES: ^d: first-differenced series. *k* represents optimal lag length chosen by Schwarz Criteria (SC) for dependent and independent variables. ^c: Critical values for Wald-F test are in brackets. ^{*}: t-statistics in parenthesis. ^{*}: statistically significant at the 10 % level. [§]: 1960-1995 period. [¶]: 1960-85 period.

Empirical model cannot reject Granger causality between macroeconomic variables and economic growth with the exception of public consumption. Granger causality test results indicate no casual link from public consumption to economic growth. Moreover, the empirical model provide no significant

evidence of causality from public investment to private investment. In the two cases where cointegrating relationship has been established, the coefficients of disequilibrium errors have the expected negative sign and are significant at the 10 per cent level.

Table 4 reports the results of growth regressions (estimated by OLS) and simple correlations between macroeconomic variables and economic growth. The true t-statistics are obtained by employing the Three Step procedure of Engle and Yoo (1991) if a cointegrating relationship exists among variables. The estimated values of elasticities are reported in Table 4 instead of regression coefficients.

Table 4. Macroeconomic performance and growth (Dependent variable is real GNP per capita for Turkey, 1965-95)

	simple correlations	I	II	III	IV	V
INF^S	-0.642	-0.3395 ^e				
		(-2.482)**				
LBD^S	-0.299		-0.2773 ^e			
			(-3.172)**			
$\Delta LBM^{f\text{I}}$	-0.639			-0.0177 ^e		
				(-3.985)**		
ΔIP^f	0.669				1.578 ^e	
					(4.75)**	
ΔIG^f	0.307					0.3071 ^e
						(1.713)*
Intercept	-	-17.317	2.027	0.0513	4.577	2.313
		(-5.845)**	(9.339)**	(3.540)**	(1.792)*	(1.712)*

NOTES: ^e: elasticities, ^f: dependent and independent variables are in first differenced form, **: significant at 5 % level, * : significant at 10 % level, t-statistics in paranthesis, ^S: 1960-1995 period. ^I: 1960-85 period.

The main results obtained from Table 4 may be summarized as follows. High inflation, large budget deficits, and exchange market distortions are associated with lower economic growth. First, the inflation rate is negatively

correlated with economic growth (Table 4, row 1 and column I). This result points to a deleterious effect of inflation on growth. An increase in the budget deficit is statistically significantly associated in table 4 with lower growth through lower capital accumulation and lower productivity growth. The distortions in the foreign exchange market are negatively and significantly correlated with economic growth (row 3 and column III; data for this variable were only available for the 1960-85 period).

As regards the variables related to investment expenditures, private investment appears as positively and significantly correlated with economic growth (row 4 and column IV). In addition, the coefficient on public investment is positive and significant at 90 % level (row 5 and column V). This suggests that the accumulation of capital has played a prominent role in Turkish economic growth in the last decades.

V. Conclusion

Employing modern time series analysis, this paper examined some empirical regularities between some proxies of macroeconomic factors and economic growth for the case of Turkey. The empirical evidence presented in this paper support the conclusions that high inflation, large budget deficits, and distorted foreign exchange markets are negatively associated with economic growth. Thus, the empirical results based on data for Turkey indicate that a government that is able to reduce the inflation rate in a sustainable way can on average expect higher growth. Controlling inflation and reducing budget deficit will help restore growth.

Some variables that aim to capture the unproductive component of public expenditures do not contribute to economic growth. The hypothesis of public consumption causing growth is not supported by the data for Turkey. However, private investment has significant and positive impact on economic growth. Moreover, public investment seems to have a positive impact on growth as well. Consequently, budget deficit reductions that rely mainly on public investment cuts could negatively influence capital accumulation and growth in Turkey.

The empirical regularities summarized in this paper suggest a negative impact of macroeconomic instability and market distortions on growth. Therefore, macroeconomic stability should be regarded as a growth prerequisite, according to the Turkish experience. On the other hand, higher priority should be given to the creation of institutional structures favorable to economic development.

References

- ALESINA, A. (1997), "The Political Economy of High and Low Growth" *Annual World Bank Conference On Development Economics*, (ed.: *The World Bank*), 217-237.
- ASCHAUER, D. A. (1989), "Is Public Expenditure Productive?" *Journal of Monetary Economics*, 23: 177-200.
- BARRO, R. J. (1990), "Government Spending in a Simple Model of Endogenous Growth" *Journal of Political Economy*, 98: 103-25.
- BARRO, R. J. (1991), "Economic Growth in a Cross Section of Countries" *Quarterly Journal of Economics*, 106: 407-443.
- BARRO, R. J. (1995), "Inflation and Economic Growth" *Bank of England Economic Bulletin*, 1-11.
- BARRO, R. and SALA-I-MARTIN (1995), *Economic Growth* (New York: McGraw Hill).
- BARTH, J. R., BRADLEY, M. (1989), "Evidence on Real Interest Effects of Money, Deficits, and Government Spending" *Quarterly Review of Economics and Business*, 29: 214-24.
- BRUNO, M. (1993), "Inflation and Growth in an Integrated Approach" *NBER Working Paper* 4422.
- CEBŪLA, R. J. (1995), "The Impact of Federal Government Budget Deficits on Economic Growth in the United States: An Empirical Investigation, 1955-1992" *International Review of Economics and Finance*, 4/3: 245-52.
- DE LONG, J. B., SUMMERS, L.H. (1992), "Macroeconomic Policy and Long-Run Growth" *Federal Reserve Bank of Kansas City, Economic Review*, 77: 5-29.
- EASTERLY, W. (1993), "How Much Do Distortions Affect Growth?" *Journal of Monetary Economics*, 32: 417-58.
- EASTERLY, W., REBELO, S. (1993), "Fiscal Policy and Economic Growth: An Empirical Investigation" *Journal of Monetary Economics*, 32: 417-58.
- ENGLE, R. F., GRANGER, C. W. J. (1987), "Co-Integration and Error-Correction: Representation, Estimation and Testing" *Econometrica*, 55: 251-76.
- ENGLE, R. F., YOO, B. S. (1991), "Cointegrating Time Series: A Survey with New Results" *Long-Run Economic Relationships: Readings in Cointegration*, (ed.: R. F. Engle, C. W. J. Granger), (New York: Oxford University Press).
- FISCHER, S. (1993), "The Role of Macroeconomic Factors in Growth" *Journal of Monetary Economics*, 32: 485-512.
- GRANGER, C. W. J. (1988), "Some Recent Developments in a Concept of Causality" *Journal of Econometrics*, 39: [99:2]1.
- HENDRY, D. F. (1986), "Econometric Modelling with Co-Integrated Variables: An Overview" *Oxford Bulletin of Economics and Statistics*, August: 201-12.
- JOHANSEN, S., JUSELIUS, K. (1990), "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money" *Oxford Bulletin of Economics and Statistics*, 52: 169-210.
- KARRAS, G. (1994), "Government Spending and Private Consumption: Some International Evidence" *Journal of Money, Credit and Banking*, 26: 9-22.
- NEWBY, W., WEST, K. (1987), "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix" *Econometrica*, 55: 703-708.
- OLSON, M. (1996), "Big Bills Left on the Sidewalk: Why Some Nations Are Rich and Others Poor" *Journal of Economic Perspectives*, 10/2: 3-24.
- ROMER, P. (1990), "Endogenous Technological Change" *Journal of Political Economy*, 98/5, Part II: 71-102.