The Pakistan Development Review
41:3 (Autumn 2002) pp. 243–254

The Determinants of Private Fixed Investment and the Relationship between Public and Private Capital Accumulation in Turkey

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The purpose of this study is to analyse the determinants of private fixed investment spending in Turkey over the period 1970–96, which covers years of both financial repression and financial liberalisation. A reformulated neoclassical investment model and a reformulated flexible accelerator investment model have been tested for the Turkish economy. The results obtained support *the accelerator principle* and the *crowding out hypothesis*, that is, public and private sector investments have been found to be substitutes. Furthermore, the hypothesis that the volume of funds is as important as the cost of funds used in financing private fixed investment has been verified. On the other hand, the so-called McKinnon-Shaw hypothesis has not been completely verified because the effect of the medium-term real lending rate on private fixed investment has been found to be negative but statistically insignificant. Finally, the financial and liberalisation programmes that have been implemented since 1983 have not yet shown any noticeable positive effects on private investment.

I. INTRODUCTION

This study attempts to specify the determinants of private fixed capital formation in less developed countries (LDCs) in general, and of the Turkish economy in particular, and to determine the interrelationship between public and private investments. Understanding what determines investment expenditure is crucial to understanding a major source of fluctuations in aggregate demand.

One of the important objectives of this study is to provide a new framework to clarify the determinants of private fixed investment behaviour empirically by examining the Turkish economy. We wish to ascertain whether public total fixed investment and private fixed investment are substitutes or complements and then to make a distinction between public investment in infrastructure and government investment of other kinds in order to answer the question: Did higher public capital

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Authors' Note: We are thankful to an anonymous referee of this journal for helpful comments on an earlier version of this paper.

accumulation "crowd out" or "crowd in" private fixed investment in Turkey during the period 1970–96? For this time period, we also want to determine empirically whether the McKinnon-Shaw hypothesis can be verified for the Turkish economy.

The plan of the paper is as follows: the two base models for fixed investment behaviour are presented in Section II. The reformulated modifications of the base models and the estimated results are discussed in Section III. Concluding remarks are made in Section IV. The definition of the variables and the sources of data are presented in the Appendix.

II. THE BENCHMARK MODELS OF THE DETERMINANTS OF PRIVATE FIXED INVESTMENT

This section will develop an investment model that can be used as a benchmark model to explain the determinants of private fixed investment behaviour in both developed countries (DCs) and LDCs. The next section will broaden the benchmark model to explain the determinants of fixed investment spending in LDCs and then apply the modified model to the Turkish economy.

Alternative models of private fixed investment behaviour differ in the determinants of the optimal level of capital, in the characterisation of the time structure of the fixed investment processes, and in the treatment of replacement investment.[1] Of the three, the most important one is the determinants of the optimal level of capital, and hence alternative models of investment behaviour differ substantially in the determinants of desired level of capital. Desired capital depends on output, capacity utilisation, internal funds, the cost of external finance, the Tobin's average q, and other variables. The time structure of the private fixed investment process, on the one hand, has been represented by finite, rational, and geometric distributed lag functions. On the other hand, it has been represented by an eclectic formulation of rational or geometric distributed lag functions, with the first weight or the first few weights arbitrary and the remaining weights declining geometrically. Finally, models of private fixed investment behaviour differ in their treatment of replacement investment, but almost all investment studies that include replacement investment explicitly assume that replacement investment is proportional to the existing capital stock.

We will derive the benchmark model of private fixed investment behaviour by using the neoclassical theory of optimal capital accumulation. We use a Constant Elasticity of Substitution (CES) production function to represent the production technology in the following form:

$$Q = A[\delta K^{-\rho} + (1-\delta)L^{-\rho}]^{\frac{-v}{\rho}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

[1]Some surveys of alternative investment models are given in Chirinko (1993); Celebi (1995); Jorgenson (1996, 1996a); Junankar (1972) and Serven and Solimano (1992).

where A, v, ρ, and δ are unknown parameters and K and L are the amount of capital and labour employed in the production process, respectively. The unknown parameter A represents the Hicks-neutral technological progress ($A>0$), v is the returns-to-scale parameter ($v>0$), ρ is the substitution parameter ($\rho>-1$), and δ is the distribution parameter ($0 \leq \delta \leq 1$) that relates the share of output to the two inputs.

A profit-maximising firm facing a perfectly competitive rental market for capital will hire additional capital input up to the point where its marginal revenue product equals the user cost of capital, c. Under perfect competition the user cost of capital reflects opportunity costs, depreciation costs, and tax costs, and is given by[2]

$$c = [q(r+d) - \Delta q]\frac{1-uz}{1-u}, \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

where q is the price of capital goods, r is the medium-term nominal interest rate, d is the rate of depreciation, u is the tax rate, and z is the present value of the depreciation deduction based on the straight-line depreciation method on one Turkish Lira's investment (after the investment tax credit). Solving the first-order conditions for profit maximisation and assuming constant returns-to-scale in the production process give the firm's demand for optimum level of capital, conditional on output, as follows:[3]

$$K^* = \delta^{\sigma} A^{\sigma-1} \delta \left(\frac{\rho}{c}\right)^{\sigma} Q, \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (3)$$

where σ is the elasticity of substitution of capital for labour.

One of the main criticisms concerning the characteristics of technology can be summarised as follows:[4] Vintage effects may influence the relation between past fixed investments and the physical capital stock entering the production function. At one extreme, vintage effects are absent if capital is "putty-putty". This assumption implies that the period in which capital good is purchased is of no particular importance. Following the "putty-putty" hypothesis requires unitary elasticity of substitution of capital for labour in the production process, and gives the following first benchmark model as a demand for capital conditional on the level of output:[5]

[2]The user cost of capital was first formulated by Jorgenson and used in almost all private fixed investment studies based on the neoclassical theory of optimal accumulation. See Jorgenson (1996, 1996a).

[3]See Eisner (1969); Eisner and Nadiri (1968) and Jorgenson (1996).

[4]See Chirinko (1993).

[5]A constant elasticity of substitution production function with unitary elasticity of substitution between capital and labour inputs reduces to a Cobb-Douglas production function. Jorgenson and Hall and Jorgenson used a Cobb-Douglas production function with constant-returns-to-scale in their investment studies. Hence, our equation for the desired level of capital—Equation (4A)—is similar to theirs.

$$K^* = \delta \frac{\rho}{c} Q. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4A)$$

At the other extreme, vintage effects do matter if capital is "putty-clay". The "putty-clay" hypothesis that requires the fixed proportions production function is widely used in empirical studies because many capital goods require a certain number of people to run them, and hence any excess of capital or labour is superfluous. In the planning stage there may be substantial possibilities for substituting capital for labour, but the "putty" hardens into "clay" once investment decisions have been made, and the capital goods have to be used with a specified amount of labour. As a result of following the "putty-clay" hypothesis, substituting zero elasticity of substitution of capital for labour into Equation (3) gives the second benchmark model of the demand for capital, conditional on the level of output, as follows:

$$K^* = \gamma Q, \text{ where } \gamma = A^{-1} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4B)$$

Since investment decisions at time t, designated by the change in the determinants of optimal capital stock, affect capital expenditures in the current and future periods, until the appropriated investment projects are completed, we may say—equivalently—that current private *net* fixed investment expenditures at time t (NIP_t) are a function of the changes in current and past demands for output as follows:

$$NIP_t = \mu(1-\lambda)\sum_{i=0}^{\infty} \lambda^i \Delta\left(\delta \frac{\rho}{c} Q\right)_{t-i}, \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5A)$$

$$NIP_t = \mu(1-\lambda)\sum_{i=0}^{\infty} \lambda^i \Delta(\gamma Q)_{t-i} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5B)$$

To convert the economic models (5A) and (5B) to statistical models, we include ε_t, independent identically distributed random variable with zero mean and constant variance. To solve the difficulty arising from estimating an infinite number of unknown parameters with a finite amount of data, we apply the so-called Koyck transformation to the statistical models. Finally, we assume that the replacement investment in each interval of time is a fixed proportion of the existing capital stock. Under these assumptions, we derive the benchmark models of the private gross fixed investment expenditure in period (IP_t) as follows:

$$IP_t = \mu(1-\lambda)\Delta\left(\delta \frac{\rho}{c} Q\right)_t + \lambda NIP_{t-1} + dKP_{t-1} + \varepsilon_t, \quad \ldots \quad \ldots \quad \ldots \quad (6A)$$

$$IP_t = \mu(1-\lambda)\Delta(\gamma Q)_t + \lambda NIP_{t-1} + dKP_{t-1} + \varepsilon_t. \quad \ldots \quad \ldots \quad \ldots \quad (6B)$$

III. THE MODIFICATION OF THE BENCHMARK MODELS AND ESTIMATED RESULTS

This section will broaden the benchmark models discussed earlier and include other possible determinants of private fixed investment expenditure in LDCs, and then will apply the modified models to the Turkish economy for the period 1970–96.

McKinnon and Shaw suggested that high positive real interest rates would raise domestic savings, would increase the volume of domestic credits, and thereby would raise the equilibrium rate of investment because they assumed that the principal constraint on investment was the quantity, rather than the cost, of financial resources.[6]

It is widely accepted that in LDCs private fixed investment and public fixed investment are related to each other even though there is considerable uncertainty about whether public sector total fixed investment raises or lowers private fixed investment.[7] We want to make a distinction between public investment in infrastructure and government investment of other kinds in order to answer the question: *Does higher public capital accumulation "crowd out" or "crowd in" private fixed investment?* Since the study by Blejer and Khan (1984), enough empirical evidence has been available to allow testing that the effect on private fixed investment would depend on the type of public fixed investment in question.

In broad terms, the financing of both public sector infrastructure and non-infrastructure investment—whether through taxes, issuance of debt, or inflation—decreases the economy's physical and financial resources available to the private sector, and thus crowds out private fixed investment. On the other hand, an increase in public sector total fixed investment—either infrastructure or non-infrastructure—, *ceteris paribus*, raises aggregate output and savings, supplementing the economy's physical and financial resources, and hence offsets at least some part of initial crowding out effects.

In particular, public infrastructure investment, such as that in highways, water and sewerage lines, and communications systems, reduces the private sector's cost of production and distribution or increases the returns to scale and hence raises the profitability of private fixed investment. This crowds in private fixed investment activity. On the other hand, since public infrastructure investment raises the productivity of the private capital stock, it reduces the private fixed investment requirements per unit of output and thus crowds out private investment. *Therefore, unlike other economists, we believe that the overall effect of public infrastructure investment on private fixed investment depends on the relative strength of these various effects, and there is no* a priori *reason to believe that public sector*

[6]See McKinnon (1973) and Shaw (1973).

[7]The relationship between public and private fixed investments for LDCs is studied in Blejer and Khan (1984); Chhibber and Wijnbergen (1988); Chhibber, Dailami and Shafik (1992); Celebi (1995, 1998); Wai and Wong (1982) and Wijnbergen, Anand, Chhibber, and Rocha (1992).

infrastructure investment crowds out or crowds in private fixed investment. However, public sector non-infrastructure investment is, on balance, more likely to crowd out private fixed investment because not only does it utilise scarce physical and financial resources that would otherwise be available to the private sector but also produces marketable output that competes with private output.

Capacity utilisation in almost all sectors is low in LDCs relative to DCs due to several reasons. It is obvious that the level of capacity utilisation has a significant impact on the timing of private fixed investment spending. If capacity utilisation is low, then private fixed investment spending will remain sluggish even if the determinants of optimal capital stock are expected to change positively and rapidly later on. The capacity utilisation rate can also be employed to control for the influence of the business cycle in explaining private fixed investment spending in LDCs.

Following the discussions above, Equation (6A) can be modified in a *semilog* functional form as a *reformulated neoclassical investment model* for a developing economy as

$$IP_t = a_0 + a_1\Delta\log(PQ/c)_t + a_2\Delta\log(PQ/c)_{t-1} + a_3\log NIP_{t-1} + a_4\log KP_{t-1} + a_5\log CRDP_t + a_6\log CUP_{t-1} + a_7\log Im_t + a_8\log IGI_{t-1} + a_9\log IGN_{t-1} + a_{10}D_{83} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7A)$$

where ε_t is the white noise and the other variables are defined in the Appendix. The coefficients a_1, a_2, a_3, a_4, a_5, a_6, and a_7 are expected to be positive, whereas a_9 negative, and a_8 and a_{10} either. The second benchmark model to be tested here is given by the modification of Equation (6B) as a *reformulated flexible accelerator model* of investment as follows[8]

$$IP_t = b_0 + b_1\Delta Q3 + b_2 NIP_{t-1} + b_3 KP_{t-1} + b_4 CRDP_t + b_5 r_t + b_6(\Delta\pi/\pi)_t + b_7 Im_t + b_8 IGI_{t-2} + b_9\, IGN_{t-2} + b_{10}D_{83} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7B)$$

The coefficients b_1, b_2, b_3, b_4, and b_7 are expected to be positive, whereas b_6 and b_9 negative, and b_5, b_8, and b_{10} either.

Both models are estimated using annual data set for the period 1970–96 for the Turkish economy using ordinary least squares.[9] The best fitting lag is determined by comparing different lags with regard to the goodness of fit. The estimated results are given by Equations (8A), (8B), (9A), (9B), and (9C). The most important difference between the two sets of Equations (8A and 8B) and (9A, 9B,

[8]When $\sigma = 0$, the neoclassical model reduces to the flexible accelerator investment model of Chenery and Koyck, and if deliver lags are absent, to the simple (rigid) accelerator model of Clark. See Chirinko (1993); Celebi (1995); Eisner and Nadiri (1968); Jorgenson (1996); Junankar (1972) and Koyck (1954).

[9]The determinants of private fixed investment of the Turkish economy for different periods are studied in Chhibber and Wijnbergen (1988); Celebi (1995, 1998); Rittenberg (1990) and Wijnbergen, Anand, Chhibber, and Rocha (1992).

9C) is that the former contains public sector *total* fixed investment, whereas the latter contains public sector infrastructure and non-infrastructure investments.

$$IP_t = -155474.41 + 81.43\Delta log(PQ/c)_t + 69.61\Delta log(PQ/c)_{t-1} + 2445.42\ logNIP_{t-1} + 8790.14\ logKPt-1$$
$$(-6.40)\quad (2.99)^*\quad (2.50)^*\quad (3.27)^*\quad (4.13)^*$$
$$+4862.68\ log\ CRDP_t + 11803.33\ logCUP_{t-1} - 5914.79\ logTIG_{t-1} - 809.14\ D_{83}$$
$$(3.54)^*\quad (2.54)^*\quad (-6.23)^*\quad (-0.91)$$
$$D\text{–}W = 2.01\quad F_{8,18} = 116.59\quad \text{Adj. } R^2 = 0.9727\quad \ldots \quad (8A)$$

$$IP_t = -5769.84 + 1.71\Delta Q3 + 0.15KP_{t-1} + 0.25CRDP_t - 29.51r_t - 6.41(\Delta\pi/\pi)_t - 0.63TIG_{t-1} - 2624.21\ D_{83}$$
$$(-5.23)^*\ (5.94)^*\quad (5.52)^*\quad (1.82)^*\quad (-1.35)\ (-1.12)\quad (-3.43)^*\quad (-2.95)^*$$
$$D\text{-}W = 1.64\quad F_{7,19} = 111.42\quad \text{Adj. } R^2 = 0.9675\quad \ldots \quad (8B)$$

$$IP_t = -126521 + 69.34\Delta log(\mathrm{PQ/c})_t + 54.44\Delta log(PQ/c)_{t-1} + 2231.12\ logNIP_{t-1} + 6130.65$$
$$(-4.1)\quad (2.51)^*\quad (1.82)^{**}\quad (2.37)^*\quad (2.47)^*$$
$$logKP_{t-1} + 4153.97\ logCRDP_t + 8172.45\ logCUP_{t-1} + 1237.95\ logIM_t - 2372.94\ logIGI_{t-1}$$
$$(1.76)^{**}\quad (1.58)\quad (0.79)\quad (-1.45)$$
$$-2116.99\ logIGN_{t-1} - 1397.41\ D_{83}$$
$$(-2.43)^*\quad (-1.29)$$
$$D\text{-}W = 1.98\quad F_{10,16} = 94.22\quad \text{Adj. } R^2 = 0.9729\quad \ldots \quad (9A)$$

$$IP_t = -1497.27 + 0.49\Delta Q3 + 0.21\ NIP_{t-1} + 0.05\ KP_{t-1} + 0.31\ CRDP_t - 44.15r_t - 1.25(\Delta\ \pi/\pi)_t$$
$$(-1.20)\quad (2.11)^*\quad (1.28)\quad (1.76)^{**}\quad (2.57)^*\quad (-2.77)^*\quad (-0.37)$$
$$+0.82\ Im_t + 0.97\ IGI_{t-2} - 1.98\ IGN_{t-2} - 1550.07\ D_{83}$$
$$(2.09)^*\quad (3.88)^*\quad (-4.03)^*\quad (-2.15)^*$$
$$D\text{-}W = 2.31\quad F_{10,16} = 236.71\quad \text{Adj. } R^2 = 0.9891\quad \ldots \quad (9B)$$

$$IP_t = 266.87 + 0.34\Delta Q3 + 0.39\ NIP_{t-1} + 0.29\ CRDP_t - 8.68\ r_t^* + 1.03Im_t + 0.829\ IGI_{t-2} - 1.159\ IGN_{t-2}$$
$$(0.36)\quad (1.94)^*\quad (3.03)^*\quad (1.94)^*\quad (-0.48)\quad (2.83)^*\quad (4.19)^*\quad (-2.71)^*$$
$$-1563.13\ D_{83}$$
$$(-2.16)^*$$
$$D\text{-}W = 2.20\quad F_{8,18} = 226.32\quad \text{Adj. } R^2 = 0.9858\quad \ldots\quad \ldots \quad (9C)$$

The computed *t*-values are given in parentheses. Statistically significant coefficients at the 5 percent and 10 percent significance levels (or below) are marked by (*) and (**), respectively.

The regression results of all estimated equations indicate that the estimated coefficients have expected signs, and in most cases they are statistically significant at $\alpha = 0.10$ level. Both adjusted R^2 and F are quite high. The F-test shows that the models can explain the variation in private fixed investment at $\alpha = 0.01$ level. At the $\alpha = 0.01$ significance level, the Durbin-Watson test shows that there is no autocorrelation in the models.

The most important aspect of the reformulated neoclassical investment model, Equations (8A) and (9A), is to find out the impact of the changes in real output weighted by the relative prices on private fixed investment spending for a developing economy. To our knowledge, this is the *first attempt* to find out the impact of this

variable for a developing economy. The results indicate that the estimated coefficients of the changes in real output weighted by the relative prices are positive and statistically significant.

Although the two models tested here can explain the variation in the private fixed investment spending *satisfactorily* because the minimum adjusted R^2 found here is 0.9675, the reformulated flexible accelerator model, Equations (8B), (9B), and (9C), fits the data better according to the goodness of fit based on adjusted R^2 and low standard error.

The Equations (8A) and (8B) clearly show that public sector *total* fixed investment has statistically significant, quantitatively quite large, and negative effect on private investment, meaning that public sector *total* fixed investment crowds out private fixed investment.

The Equations (9A), (9B), and (9C) clearly show that the coefficient of public non-infrastructure investment is negative and statistically significant, which is in agreement with other studies. This result implies that public non-infrastructure investment and private fixed investment are clearly substitutes. However, the two models tested here do not provide consistent results about the effect of public sector infrastructure investment. The flexible accelerator model indicates that public infrastructure investment and private investment are complements, whereas the neoclassical model does not confirm this conclusion. This may be due to the fact that the dependent variable includes fixed investments in ten sectors, of which the four major sectors, agriculture, manufacturing, transportation and communications, and construction, constitute about 90 percent of total private fixed investment. Disaggregating the private fixed investment into these four major sectors and then estimating each of them separately will most likely produce consistent results.

The results show that the availability of credit to the private sector is significantly important in explaining private investment, which is also in agreement with other studies on investment for LDCs. The so-called McKinnon-Shaw hypothesis has not been completely verified because the medium-term real interest rate in Equation (9C) is negative but statistically insignificant.

The financial and liberalisation programmes that have been implemented since 1983 have not yet shown any positive effects on private fixed investment. They would have affected private capital formation positively only if the bank deposits and real capital goods had not been close substitutes, the banking sector had efficiently distributed domestic credits, and the public sector borrowing requirements had been reduced. Our results do not support this sequence of events because the financial and liberalisation programmes have dramatically increased not only public sector borrowing requirements but also real interest rates.

The effect of uncertainty and instability in the macroeconomic climate (represented by the percentage change in the annual inflation rate) on private investment has been found to be negative but not statistically significant. An

increase in the capacity utilisation index (used to control the effects of the business cycle on private fixed investment) in a given year is followed by a large increase in private fixed investment spending during the following year. The effect of the volume of imported investment goods on private fixed investment has been found to be statistically significant, quantitatively *quite* large, and positive, showing that the dependency of private capital formation on imported investment goods is quite large.

IV. CONCLUSIONS

The purpose of this study has been to analyse the impact of government policy on private fixed investment spending in Turkey over the period 1970–96, which covers years of both financial repression and financial liberalisation. As pointed out earlier, the results obtained support *the accelerator principle* and the *crowding out hypothesis*.

The hypothesis that the volume of funds is as important as the cost of funds used in financing private fixed investment has been verified since both the quantity and the cost of credit have had significant impacts on private investment. The effect of real domestic credits granted to the private sector on private investment spending has been found to be statistically significant, quantitatively strong, and positive in both models. The McKinnon-Shaw hypothesis has not been completely verified because the effect of the medium-term real lending rate on private investment has been found to be negative but statistically insignificant.

Public sector *total* fixed investment has had statistically significant, quantitatively quite large, and negative effects on private fixed investment in both models. This clearly indicates that public sector total fixed investment, on balance, crowds out private fixed investment. Moreover, public sector non-infrastructure fixed investment has had statistically significant, quantitatively quite large, and negative effects on private fixed investment, meaning that public sector non-infrastructure fixed investment and private sector fixed investment are substitutes. However, the results obtained from the two models are not robust about the effect of public sector infrastructure investment on private fixed investment. The result of the flexible accelerator model indicates that public infrastructure investment and private investment are complements, whereas the neoclassical model does not confirm this conclusion. Disaggregating private investment into four major sectors and estimating each separately will most likely produce consistent results.

APPENDIX

THE DEFINITION OF THE VARIABLES AND DATA SOURCES

The basic sources for the data used in Section III are the State Planning Organisation (SPO), the State Institute of Statistics (SIS), T. R. Central Bank (TRCB), and the Ministry of Finance (MF). The data were deflated by the GNP

deflator (1987=1.00) to express them in real terms.

CRDP: The real domestic credits granted to the private sector, at 1987 prices, billion TL. Source: TRCB and SIS.

CUP: Private sector capacity utilisation in the manufacturing industry. Source: SPO and SIS.

π: Inflation rate measured by the GNP implicit deflator. Source: SIS.

$\Delta\pi/\pi$: The percentage change in inflation measured by the GNP implicit deflator. Source: SIS.

Q: Real gross national products given by (PQ/P).

$\Delta Q3$: The change in moving average of real GNP of the previous three years given by the following formula: $\Delta Q3=((\Delta Q)_{t-1}+ (\Delta Q)_{t-2}+(\Delta Q)_{t-3})/3$.

D83: The intercept-dummy variable measuring the effect of the financial liberalisation programme on the private fixed investment takes the value of 1 for the 1983–96 and 0 for the other years.

r: The medium-term nominal interest rate. Source: TRCB.

r*: The medium-term real interest rate. $r^*=(r-\pi)/(1+\pi)$. Source: TRCB and SIS.

IGI: Public sector gross fixed infrastructural investment deflated by a public investment goods price index, at 1987 prices, billion TL. It includes irrigation, power, transportations, communications, tourism, health, education, and water and sewerage systems. Source: SPO.

IGN: Public sector gross fixed non-infrastructural investment deflated by public investment goods price index, at 1987 prices, billion TL. Source: SPO.

Im: The real investment-goods imports, at 1987 prices, billion TL. Source: SPO, SIS.

IP: Private sector gross fixed investment deflated by a private sector investment goods price index, at 1987 prices, billion TL. Source: SPO.

KP: Private sector fixed capital stock, at 1987 prices, billion TL.

NIP: Private sector net fixed investment, at 1987 prices, billion TL. $NIP_t=IP_t-d^*KP_{t-1}$.

P: The GNP implicit deflators index (1987=1.00). Source: SIS.

PQ: Nominal gross national product, billion TL. Source: SIS.

Pp: Private sector fixed investment deflator (1987=1.00). Source: SPO.

TIG: Public sector real gross fixed investment, billion TL. $TIG_t=IGI_t+IGN_t$.

u: The tax rate. Source: MF.

z: The present value of the depreciation deduction on one Turkish Lira's investment (after investment tax credit). Source: MF.

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