THE EFFECTS OF THE PROMOTIVE MEASURES ON INVESTMENT

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ABSTRACT

The purpose of this work is to try to measure the effects of subsidies on fixed capital investment during the period 1963 - 1980 employing a Neoclassical theory of optimum capital formation.

The promotive measures adopted are as follows;

a) Tax rebates for investment,

b) Custom tax installments

c) Complete and partial custom tax exemptions,

d) Low interest investment credits.

This research is composed of six sections. In the first section, the Neoclassical theory of optimal capital formation is summarised and the theory is extended in order to cover the effects of tax rebates for investmend. In the second and third sections Dale W. Jorgenson's "Neoclassical" investment model and econometrics of the model are discussed, respectively. In the forth section, the adopted promotive measures are described and the effects of promotive measures on the determination of the price of capital services are calculated. In the fifth section, Dale W.Jorgenson's theory of investment which was discussed in the previous sections applied to annual Turkish data for the period 1958 - 1980 and using the price of capital services data calculated in section Four, the coefficients of the investment function is determined. In the final section, the cost of capital services in case of no promotive measures is calculated and given the coefficients of the investment function determined in section Five, the investment levels in the case of no promotive measures are estimated. The difference between the actual gross investment levels and the estimated gross investment levels in case of

no subsidy is the amount of increase caused by the promotive measures on gross investment. Then, the cost of capital services are calculated seperatly in the case of only taxrebates for investment, only custom tax installments, only complete and partial custom tax exemptions and only low interest investment credits are to be applied. The weights are given to the each promotive measure according to the difference between the cost of capital services in case of no subsidy and only that promotive measure is applied. The amount of increase caused by the promotive measures is distributed among the subsidies according to the given weights in order to obtain the individual effectsof each promotive measure.

INTRODUCTION

The effects of subsidies on investment behavior have been one of the most frequently discussed economic issues in Turkey since 1963, when the policy of subsidizing private investors started. While the discussions on the effects of subsidies which were based on beliefs rather than empirical findings continued*, implementation has gradually expandedby the addition of custom tax installments, complete or partial exemptionon custom taxes and low interest investment credits measures to tax rebate for investment which was the first promotive measure.

The belief that subsidies on investment will effect investment decisions is supported by the basic economic rule that demand for capital goods will be greater when the cost of capital goods is low. However, the form and the magnitude of this relationship between the cost of capital goods and investment expenditures have not been quantified by the results of anempirical work based on the implementation results. For this reason,

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* "The Encouraging Measures for Investment in Turkey"
Doc. Dr. Aykut Herekmen (Türkiye'de Yatirmları Teşvik Tedbirleri)

"Turkish Industry in the Planned Period. The Subsidies, the Progresses and Basic Problems" (Planlı dönemde Türk Sanayii. Teşvik.Gelişmeler
Dr. A.İlhan Eronat ve Temel Sorunlar)

"Subsidies in the economy" Cahit Deniz. Selim Önen
19-23 November 1975, Press, Cumhuriyet (Ekonomide Teşvik Tedbirleri)

the question of what amount of investment caused by a certain encouraging measure, which is very important from economic policy point of view, has been left unanswered.

While trying to find the answers, we have come across quite a few problems whch were mostly due to lack of data on the implementation results of the subsidies. Hence, certain assumptions had to be made in order to obtain the reasonably rough but certainly clear results.

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THE THEORY OF CAPITAL

The investment model used in the analysis, is Dale Jorgenson's "Neoclassical" investment model[1]. He has developed a sophisticated re-formulation of the Classical theory of investment which he, and others, have used to derive the specifications of investment equations for a wide variety of empirical work.

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[1] "Capital Theory and Investment Behaviour"
Dale W.Jorgnson, American Economic Review, 1963,
Papers and Proceedings, vol.53, pp. 247 - 59

"Anticipations and Investment Behaviour"
Dale W.Jorgenson, 1965, in Duesenberry,J.S, Fromm,G.,
Klein, L.R. and Kuh, E. (eds.).'The Brookings Quarterly
Economic Model of the UK Economy'. Chicago: Rand Mc.Nally

"The Theory of Investment Behaviour"
Dale W.Jorgenson, 1967, in Ferber, R. (ed.). 'Determinants
of Investment Behaviour'. New York: National Bureau of
Economic Research.

"Econometric Studies of Investment BEhavior: a survey"
Dale W.Jorgenson, 1971, Journal of Economic Literature,
Vol. 9, pp. 1111 - 47

"Investment Behaviour in US manufacturing, 1947 - 1960"
Dale W.Jorgenson and J.A.Stephenson, 1967, Econometrica,
Vol. 35, pp. 169 - 220

Before developing the theory of investment behavior, the "Neoclassical" theory of optimal accumulation of capital is considered. The criterion for optimal accumulation is to maximize the present value of the firm: The productive process could be characterized by a production function relating flows of output to flows of labor and capital services and that the firm supplies capital services to itself through the acquisition goods. For simplicity the analysis is assumed to be processing a single output, a single labor input, anda single investment good. Because of the importance of direct taxation of business income, which is largely corporate, a detailed description of the structure is included in the analysis. Direct taxes are based on the business income as defined for tax purposes, and the definition of business income depends on the tax treatment of depreciation, the cost of capital, and capital gains and losses.

The present value of the firm is defined as the sure of discounted future revenues, less discounted future outlays on both current and capital account whereoutlays include direct taxes. Present value of the firm is maximized subjict to two constraints. First, where K is the flow of capital services, L the flow of labor services, and Q the flow of output and input are constrained by a production function;

$$F(Q,L,K) = 0 \tag{1}$$

The production function is assumed to be strictly convex and twice - differtiable with a positive marginal rate of substitution between inputs and positive marginal productivities of both inputs. Secondly, net investment is equal to total investment less replacement, where replacement is proportional to capital stock. This constraint takes the form;

(2) $\dot{K} = I - \lambda K$

Where I is gross investment and $\dot{K}$ is the rate of change of capital i.e. net investment, $\frac{dK}{dt}$ let p be the price of output, s theprice of labor sirvices, and q the price of investment goods, the difference between revenue and otlays on both current and capital account, say R represents the value of the firm;

(3) $R = pQ - sL - qI$

Income tax purposes is the difference between revenue and otlay on current account, less certain charges against income allowable for tax purposes. Under the assumption that replacement is proportional to capital stock, replacement cost in current prices is λ q K. If v is the proportion of current replacement cost allowable as a charge against income for tax purposes, the depreciation charge is v λ q K. Similarly, where r is the cost of capital, the total cost of capital is r q K. If w is the proportion of the cost of capital than it becomes w r q K. Finally, total capital gain on assets is $\dot{q}$ K, where $\dot{q}$ is the rate of change of the price of capital goods; if x is the porportion of capital gains charged to income, this charge is x $\dot{q}$ K. If we let u represent the tax rate, direct taxes, say D, are equal to the tax rate multiplied by income for tax purposes;

(4) $D = u[pQ - sL - v\lambda qK - wrqK + x\dot{q}K]$

The present value of the firm, say V, is defined as the integral of discounted revenue, less discounted outlays on both current and capital account less

discounted direct taxes; where r is the rate of discount;

$$(5) \qquad V = \int_o^{\infty} e^{-rt}[R - D]\, dt$$

When we use the Lagrangian expression in order to maximize present value (5) subject to the constraints (1) and (2);

$$(6) \qquad \alpha = \int_o^{\infty} \{e^{-rt}[R - D] + \sqrt{o}(t)F(Q,L,K) + \sqrt{_i}(t)[\dot{K} - I + \lambda K]\}\, dt$$

$$= \int_o^{\infty} f(t)dt,$$

where,

$$f(t) = e^{-rt}[R - D] + \sqrt{o}(t)F(Q,L,K) + \sqrt{_i}(t)[\dot{K} - I + \lambda K]$$

So the necessary conditions for a maximum of present value subject to the constrains are;

$$\frac{\partial f}{\partial Q} = e^{-rt}(1 - u)p + \sqrt{o}(t) \frac{\partial F}{\partial Q} = 0$$

$$\frac{\partial f}{\partial L} = - e^{-rt}(1 - u)s + \sqrt{o}(t) \frac{\partial F}{\partial L}$$

$$(7) \qquad \frac{\partial f}{\partial L} = - e^{-rt}q - \sqrt{_i}(t) = 0$$

$$\frac{\partial f}{\partial k} - \frac{d}{dt} - \frac{\partial f}{\partial K} = e^{-rt}uq\{v\lambda + wr - x\frac{\dot{q}}{q}\} + \sqrt{o}(t) \frac{\partial F}{\partial K} + \sqrt{_i}(t)\lambda - \frac{d}{dt}\sqrt{_i}(t) = 0$$

$$(8) \qquad \frac{\partial f}{\partial \sqrt{o}} = F(Q,L,K) = 0$$

$$\frac{\partial f}{\partial \sqrt{_i}} = \dot{K} - I + \lambda K = 0$$

Combining the necessary conditions for labor and output, marginal productivity condition for labor can be obtained, as;

$$\frac{\partial Q}{\partial L} = \frac{s}{p}$$

Similarly, marginal productivity condition for capital can be derived by solving the necessary condition(7) for $\sqrt{}_1(t) = -e^{-rt}q$.The necessary condition for capital can be written as;

$$\sqrt{}o(t)\ \frac{\partial F}{\partial K} - e^{-rt}q\{(1 - uv)\lambda + (1 - uw)r - (1 - ux)\frac{\dot{q}}{q}\} = 0$$

When we put togther this condition with the necessary condition for output, we obtain the marginal productivity condition for capital services;

$$(9)\ \frac{\partial Q}{\partial K} = \frac{q\{[\frac{1 - uv}{1 - u}]\lambda + [\frac{1 - uw}{1 - u}]r - [\frac{1 - ux}{1 - u}]\frac{\dot{q}}{q}\}}{p} = \frac{c}{p}$$

where,

$$(10)\quad c = \frac{q}{1 - u}\{(1 - uv)\lambda + (1 - uw)r - (1 - ux)\frac{\dot{q}}{q}\}$$

The variable c(t) in this equation (10) is the rental price of capital services. It is the weighted sum of the rate of replacement, the cost of capital and the rate of capital gain (loss) with weights given by the tax structure, multiplied by the price of investment goods. The capital gain (loss) term, however, is generally ignored in the empirical analysis

D.W.Jorgenson and J.A.Stephenson in their empirical work (1967)[2] assumed that all capital gains and losses were treated as transitory by each firm, so that the weights associated with the rate of change of the price of investment goods was zero. The weights for the rate of replacement and the cost of capital depend on the tax rate applied to income and the proportion of current replacement and the total cost of capital allowable changes income for tax purposes. So they defined the price of capital services as;

$$C_t = -\frac{q_t}{1 - u_t}[(1 - u_t v_t)\lambda + (1 - u_t w_t)r_t]$$

where,

q_t is the price of investment goods.

u_t is the tax rate.

v_t is the proportion of current replacement.

w_t is the proportion of total cost of capital allowable for tax purposes.

λ is the rate of replacement and estimated from the calculation of capital stock.

r_t is the cost of capital

A year later Dale W.Jorgenson did another study with Carvin D.Siebert[3],

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[2] "Investment Behavior in U.S. Manufacturing 1947-1960" Dale W.Jorgenson and James A.Stephenson Econometrica Vol.35

[3] "A Comparison of Alternative Theories of Corporate Investment Behavior" D.W.Jorgenson and C.D. Siebert The American Economic Review. September 1968. Vol. 58

The purpose of their study was to compare Neoclassical investment behavior with its alternatives such as the Accelerator theory of investment behavior, the Liquidity theory of investment behavior and Expected Profits theory of investment behavior. Their conclusion was that the Neoclassical theory of investment behavior was superior to the others. In their work they defined the price of capital services as;

$$C_t = \frac{q_t}{1 - u_t} [(1 - u_t w_t)\lambda + r_t - \frac{q_t - q_{t-1}}{q_t}]$$

In this definition, capital gains are assumed to be taken into account in investment decisions and the effect of the proportion of current replacement on the price of capital services is ignored.

In my analysis with minor changes this definition of the price of capital services used since it contained less variables compared to the original definition.

I ignored the effect of capital gains (losses) on the investment decisions. So they are assumed to be transitory in order to find a mere effect of the given subsidies on the investment decisions rather than a combined one with capital gains (losses). The analysis which is previously discussed about the price of capital goods could be extended in order to cover the effects of the tax rebates on investment. Tax rebates on investment purposes. It is applied to the part of the cost of capital goods which is supplied by the firm's net capital. According to the tax purposes additional to teh normal depreciation. So if "k" is denoted as present value of special depreciation for one unit of capital good, then the previous definition of the price of capital services becomes;

$$C_t = \frac{q_t}{1 - ut} [(1 - u_t w_t - u_t k_t)\lambda_t + r_t]$$

where,

q_t is the price of invsetment goods.

u_t is the corparate tax rate.

w_t is the present value of depreciation.

k_t is the present value of tax rebates.

λ_t is the rate of replacement

r_t is the interest rate

This equality will be used to determine the price of capital services in the analysis.

THE INVESTMENT MODEL

If ther is no lag in the completion of investment projects the level of investment appropiate for optimal capital accumulation may be determined from the necessary conditions (7) and (8). However investment projects take time to complete, so instantaneous achievement of the optimal capital stock position is not possible, and new machines ordered today will only be delivered at some future point in time. Accordingly, Jorgenson postulates an iterative decision process, whereby first output and labor input are determined by the production function and the marginal productivity condition for labor, given the existing capital stock, then the desired capital skock K^+ is determined by the marginal productivity condition for capital while the actual level of capital is determined by the constraint (2). Finally, he assumes that the desired level of capital is equal to the actual level of capital plus the backlog of uncompleted investment projects. If the production function has the Cobb - Douglas form, this marginal productivity condition may be written;

$$F_k = \alpha \frac{Q}{K^+} = \frac{c}{p} , \quad F_L = \beta \frac{Q}{L} = \frac{s}{p} ,$$

Where α is the elasticity of output with respect to the input of capital services, β is the elasticity of output with respect to the labor input and K^+ is desired capital. Solving for desired capital he obtains,

$$K^+ = \alpha \frac{pQ}{c}$$

To provide a formal representation of this theory of investment, he lets the proportion of investment projects initiated in period t and completed

in period t + r be μ_τ. The distribution of completions over time may be represented by a sequence of nonnegative numbers;

(11) $$\mu_0, \mu_1, \mu_2, \ldots\ldots$$

If all investment projects are eventually completed, the sum of the elements in this sequence is unity;

(12) $$\sum_{\tau=0}^{\infty} \mu_\tau = 1$$

He denotes the level of investment expenditures for expansion of capital in period t by I_t^E and the level of projects initiated in this period by I_t^N. In every period the level of actual investment expenditures is a weighted average of the level of projects initiated in all previous periods;

(13) $$I_t^E = \mu_0 I_t^N + \mu_1 I_{t-1}^N + \ldots\ldots$$

When the lag operator S, defined as $S x_t = x_{t-1}$ for any sequence $\{x_t\}$, is used, the weighted average (13) may be written in the form;

$$I_t^E = \mu(s) I_t^N$$

Where $\mu(s)$ is a power series in the lag operator, $\mu(s) = \mu_0 + \mu_1 s + \ldots\ldots$

It is assumed that the desired level, of capital is equal to the actual level less the backlog of uncompleted investment projects. This assumption implies that new projects are initiated in each period until the backlog of uncompleted projects is equal to the difference between

desired capital, say K_t^+, and actual capital, K_t. The backlog of uncompleted projects at the beginning of period t is the sum of the uncompleted portions of all projects initiated previously. This backlog is equal to the difference between desired and actual capital;

$$(14) \qquad K_t^+ - K_t = I_t^N + (1 - \mu_0)I_{t-1}^N + (1 - \mu_0 - \mu_1)I_{t-2}^N + \ldots\ldots$$

Using the notation for a lag operator introduced previously, the mechanism for the initiation of investment projects may be written;

$$K_t^+ - K_t = \frac{1 - s\mu(s)}{1 - s} I_t^N,$$

Where $1/(1 - s) = 1 + s + s^2 + \ldots\ldots$ This mechanism may be interpreted in two ways. First, new investment starts in each period are equal to the change in desired capital stock;

$$I_t^N = K_t^+ - K_{t-1}^+$$

Second, using the distributed lag function (13), investment for the expansion of capital is a weighted average of past changes in desired capital stock;

$$(15) \qquad I_t^E = \mu(s)[K_t^+ - K_{t-1}^+]$$

Next, Jorgenson turns to investment for replacement of previously acquired investment goods. He lets the proportion of investment goods acquired at time t and replaced in period $t + \tau$ be $\zeta\tau$. The distribution of replacements over time may be represented by a sequence of nonnegative numbers;

(16) $\zeta_0, \zeta_1, \zeta_2, \ldots\ldots$

If all investment goods are eventually replaced, the sum of the elements in this sequence is unity;

(17) $\sum_{\tau=0}^{\infty} \zeta_\tau = 1$

Replacement investment, say I_t^R, is a weighted average of past gross investment, say I_t;

(18) $I_t^R = \zeta(s) I_t$

Where $\zeta(s)$ is a power series in the lag operator $\zeta(s) = \zeta_0 + \zeta_1 s + \ldots\ldots$ Capital stock at the beginning of the period is the sum of past net investment;

$$K_{t+1} = \sum_{\tau=0}^{\infty} [I_{t-\tau} - I_{t-\tau}^R]$$

Hence, replacement investment may be expressed as a function of past values of capital stock;

$$I_t^R = \frac{\zeta(s)[1 - s]}{1 - \zeta(s)} K_{t+1}$$

It is assumed that the distribution of replacements over time is geometric. Under this assumption, the power $\zeta(s)$ takes the form;

$$\zeta(s) = \lambda s + \lambda(1 - \lambda)s + \ldots\ldots$$

The expression (18) relating replacement investment to past gross invest-

ments becomes;

$$I_t^R = \lambda I_{t-1} + \lambda(1 - \lambda)I_{t-2} + \ldots\ldots$$

Similarly, the expression (19) relating replacement investment to past values of capital stock becomes;

$$I_t^R = \lambda K_t$$

The theory of investment behavior results from combining the theory of investment for expansion of capital with the theory of replacement investment. Gross investment is the sum of these two components of investment;

$$I_t = I_t^E + I_t^R$$

Replacement investment is proportional to capital stock and investment for expansion is a weighted average of past changes in desired capital, so that the theory of investment behavior can be obtained by incorporating the determinants of desired capital stock, as follows;

(19) $$I_t = \mu(s)[K_t^+ - K_{t-1}^+] + \lambda K_t$$

ECONOMETRICS OF THE MODEL

The theory of investment behavior (19) corresponds to a distributed lag function in net investment and changes in desired capital;

$$[I_t - \lambda K_t] = \mu(s)[K_t^+ - K_{t-1}^+]$$

Furthermore, the sequence of coefficients $\{\mu_\tau\}$ of the distributed lag function corresponds to the probability distribution of a nonnegative, integer-valued, random variable;

$$\mu_\tau \geqslant 0 \qquad (\tau = 0, 1, \ldots)$$

$$\sum_{\tau=0}^{\infty} \mu_\tau = 1$$

It is assumed that the sequence of coefficients $\{\mu_\tau\}$ of the distributed lag function has a rational generating function. Under this assumption the distributed lag function may be written;

$$(20) \qquad [I_t - \lambda K_t] = \frac{\gamma(s)}{w(s)} [K_t^+ - K_{t-1}^+]$$

Where $\gamma(s)$ and $w(s)$ are polynomials in the lag operator. Multiplying both sides of the distributed lag function (20) by $w(s)$, we obtain the final form of this function;

$$w(s)[I_t - \lambda K_t] = \gamma(s)[K_t^+ - K_{t-1}^+]$$

or,

$$[1 + w_1 s + \ldots + w_n s^n][I_t - \lambda K_t] = [\gamma_0 + \gamma_1 s + \ldots + \gamma_m s^m][K_t^+ - K_{t-1}^+]$$

so that the final form for the distributed lag function may be written;

$$(21) \quad [I_t - \lambda K_t] + w_1[I_{t-1} - \lambda K_{t-1}] + \ldots + w_n[I_{t-n} - \lambda K_{t-n}]$$
$$= \gamma_0(K^+_t - K^+_{t-1}) + \gamma_1(K^+_{t-1} - K^+_{t-2}) + \ldots + \gamma_m(K^+_{t-m} - K^+_{t-m-1})$$

To obtain the flexible accelerator as a special case of this distributed lag function, we choose the polynomials $w(s)$ and $\gamma(s)$ as follows;

$$w(s) = 1 - \sqrt{}$$
$$\gamma(s) = 1 - \sqrt{s}$$

For a rational distributed lag function an estimator of the unknown parameters $\{w_\tau\}$ and $\{\gamma_\tau\}$ which is optimal from the large-sample point of view may be derived for a stochastic specification in which a random term ε_t is added to the final form of the distributed lag function;

$$(22) \quad [I_t - \lambda K_t] = \gamma_0[K^+_t - K^+_{t-1}] + \gamma_1[K^+_{t-1} - K^+_{t-2}] + \ldots + \gamma_m[K^+_{t-m} -$$
$$K_{t-m-1}] - w_1[I_{t-1} - \lambda K_{t-1}] - \ldots - w_n[I_{t-n} - \lambda K_{t-n}] + \varepsilon_t$$
$$t = 1, 2, \ldots N$$

Where N is the number of observations. Provided that the error ε_t is distributed independently and identically over time and distributed independently of all values of changes in desired capital stock, and provided further that the distributed lag function (21) considered as a difference equation in net investment is stable, the ordinary least squares estimator of the unknown prameters is best, asymptotically normal.

Using the fact that the sequence of coefficients $\{\mu_t\}$ of the distribution

function corresponds to the probability distribution of a nonnegative, integer-valued, random variable we derive certain restrictions on the parameters $\{\gamma_\tau\}$ and $\{w_\tau\}$. The complete set of conditions my be used as a test of the hypothesis that the coefficients $\{\mu_\tau\}$ correspond to the probability distribution of a nonnegative, integer-valued, random variable. Alternatively, this set of conditions may be used as constraints on the estimates of the parameters $\{\gamma_\tau\}$ and $\{w_\tau\}$ to increase the efficiency of estimation.

In theory of investment behavior corresponding to a Cobb-Douglas production function, changes in desired capital are known only up to a multiplcative constant, the elasticity of output with respect to capital input α The constraint that the sum of the sequence of coefficients is unity may be used to obtain an estimator of this elasticity. First, an estimator of the parameters $\{w_\tau\}$ and $\{\gamma_\tau\alpha\}$ may be obtained from the distributed lag function;

$$(23) \qquad [I_t - \lambda K_t] + w_1[I_{t-1} - \lambda K_{t-1}] + \ldots + w_n[I_{t-n} - \lambda K_{t-n}] =$$

$$\gamma_o\alpha\left[\frac{p_t Q_t}{c_t} - \frac{p_{t-1} Q_{t-1}}{c_{t-1}}\right] + \ldots + \gamma_m\alpha\left[\frac{p_{t-m} Q_{t-m}}{c_{t-m}} - \frac{p_{t-m-1} Q_{t-m-1}}{c_{t-m}}\right]$$

Secondly, where $\{\hat{w}_\tau\}$ is an estimator of $\{w_\tau\}$ and $\{\hat{\gamma_\tau\alpha}\}$ is an estimator of $\{\hat{\gamma_\tau\alpha}\}$, an estimator of α, say $\hat{\alpha}$, may be obtained from the constraints as follows;

$$(24) \qquad \hat{\alpha} = \frac{\sum_{\tau=o}^{m} \hat{\gamma_\tau\alpha}}{\sum_{\tau=o}^{n} \hat{w}_\tau}$$

This estimator is consistent and efficient wherever the estimators $\{\hat{w}_\tau\}$ and $\{\hat{\gamma_\tau\alpha}\}$ are consistent and efficient.

THE EFFECTS OF SUBSIDIES ON THE DETERMINATION OF THE PRICE OF CAPITAL SERVICES

All the promotive measures which are included in the analysis will take place in the calculation of cost of capital services[4] in the following manner, as described below;

I) Tax Rebate for Investment

This is a kind of supplement of the state for appropriate investments of private to the development plan, through exception of tax. The purpose of the tax rebate is to encourage private sector to invest on the sectors which are defined by the development plan. The character of the plan is not a must but a guidence for the private sector. For that reason, tax rebate for investment and all other subsidies were thofght to be important and efficient tools in order to carry out the development plan succesfully.

The concept of tax rebate for investment had been put in order with 202 numbered income tax code and 199 numbered corparate tax code. It has been started to be applied since 1963. In the form which was first accepted, the rate of tax rebate for investment was in general 30 per cent for agricultural investments and investments on regional development 40 per cent and for investments in underdeveloped regions 50 per cent. After four years of application, regarding application bases of the development plan, which was put in effect on 11.8.1967, the peak of investment reduction was raised to 80 per cent for the purpose of more elastic and

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[4] See Table 1, pp.37-41

efficient encouragement. It is decreed that, the rates to be applied depending on regions and economic sectors, to be determined not exceeding this peak. However, this application was removed from effect by the 25.10.1969 dated decree of the Court of Constitution. After this date, in the application of tax rebate for investment, again the rates agreed by the 202 numbered income tax code, were taken as base.

In veiw of these informations, tax rebates for investment may be interpreted as, to subject a certain rate of the part of investment, covered by net capiatl, to a special depreciation in addition to the normal depreciation allowed in a short period[5] . The difference of tax rebate of investment from depreciation is that, there is no decrease of value of capital goods in the tax rebate of investment, but in application tax rebate gives the samei incentive to the investor as depreciation does, by subtracting a certain part of investment sum from profits, it causes a reduction on the tax amount which is going to be paid. So if an investor is given the right to use the tax rebate for investment by law, then for the same investment, he will get tax reduction from the normal depreciation and from the tax rebate at agreed rates.

According to the application results, related with the tax rebate for investment, within the period 1963 and 1971, the tax rebate was given to investment of 15,989,597,400 TL., 8,574,229,400 TL. of which was covered by net capital[5] . From this subsidy, mostly the investments in the developed

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[5] According to the information, which the research group of the Industrial Development Bank of Turkey received from investor groups, approximately in three years after the investment completed.

[5] "Investment and Exportation Subsidies"
Conference Group of Economic and Social Studies, Istanbul 1971
"Investment and Exportation Subsidies and Results of Application"

regions of the county made use; for example, although more than 60 per cent of the acceptable tax rebate exception was related with the investments in the Marmara region, the share of Eastern Anatalia region was around one per cent[7] . In this case, considering that approximately 40 per cent of the part of investment covered by net capital, is subjected to the special depreciation. It is concluded that, 0.2145 liras of an investment of one lira, 0.5362 liras of which is covered by net capital, will be subject to the special depreciation in three years.

When we consider the interest rates after 1963, which was the beginning of application of tax rebate for investment, we conclude the following results about the present value of the tax rebate, related to one unit of investment on that date[8].

Year	Interest rate	Present Value of Tax Rebate
1963-69	0.126	16.0446
1970	0.13125	15.8194
1971-72	0.14375	15.2832
1973-74	0.13125	15.8194
1975-77	0.14375	15.2832
1978	0.2	12.87
1979	0.2375	11.2612
1980	0.2625	10.1887

[7] II. Five Year Development Plan 1971 Program Table:484
DPT. 1044 April 18th,1971

[8] See Table 2, pp.42-43

II) Custom tax installments

By the third article of 474 numbered Law code, which was put in effect on date 25.5.1964 custom tax and duties (Custom Tax, Municipal Share, Quay Duty, Production Tax) of the goods ihich are considered as investment goods and the importation of which are within the purpose of long term plan, is to be subjected to installments. Installments will be collected by equal annual shares in a period of at most five years after they pass custom line, provided that the first installment is payed in advance.

The purpose of this measure is to decrease the cost of investment goods and at the same time facilitate finance to private investor.

The application results, related with custom tax installments, during the period dated from 25.5.1964, in which 474 numbered law code was put in effect, up to 31.12.1970, are summarized below[5].

Total investments.....13,509,286,882 TL.

Installed taxes.....938,300,000 TL.

According to these results, for one unit of investment, 0.07 liras of custom tax was installed.

The reduction in the price of investment goods caused by the financing facility given to investor as a result of the custom tax installments. According to the interest rates, which are applied after 1965 when this subsidy began to be applied, the reduction in the price one unit of investment good, caused by the custom tax installments as mentioned above

is as follows[9] ;

Year	Interest Rate	Present Value of the Reduction in the Price of Investment Goods (per cent)
1965-69	0.126	2.646
1970	0.13125	2.756
1971-72	0.14375	2.975
1973-74	0.13125	2.756
1975-77	0.14375	2.975
1978	0.2	4.2
1979	0.2375	4.987
1980	0.2625	5.512

II) Complete and partial custom tax exemptions

We may summarize the measures, which are related with custom tax and duties, applied in order to decrease investment cost and to maintain financing facility to investors, as follows;

By decrees, to be able to make changes on tax rates in the custom entrance tariff list, maintained by 14.5.1964 dated and 474 numbered law code.

To exempt completely or partially investment goods from custom tax and duties, by 27.7.1967 dated and 933 numbered law code.

After he related article of 933 numbered law code was cancelled by the

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[9] See Table 3.pp 44-45

Court of Constitution on date 25.10.1969, in order to remove the inequality between investments, 6/12585 numbered decree was put in effect with the right given by 474 numbered law. According to the decree custom tax rate of the importation related with investments carrying the following conditions is accepted to be zero;

1) To maintain Turkish Industrial Products power to compete in foreign markets,
2) To maintain opportunity for he transfer of new production technology to Turkey,
3) To maintain new foundations to be established in economical capacities suitable to the foundations present or being established in the world, or old fondations to be renewed with these conditions.

The implmentation results related with custom tax and duties of the promotive measure mentioned above are summarized below[10];

	1968-69	1970
Total Investment (000 TL.)	9,976,886	8,111,192
Complete or Partial Custom Tax Exemptions (000 TL.)	2,666,330	2,529,148
Exempted Taxes/Total Investment	0.267	0.312

According to these results, because of the complete or partial exemption on custom tax and duties, 26.7 per cent of reduction within the period 1968-1969 according to 933 numbered law code and after the period 1970 according to 6/12585 numbered law code, 31.2 per cent of reduction on the

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[10] II. Five Year Development Plan, 1971 Program Table: 489

price of investment goods were supplied to private investors.

A problem, which was come across when calculating the effects of these subsidies on the price of investment goods was solved as described below.

In cases where in the same year, the custom tax installments is applied to one part and the custom tax exemption to another part of investment, the reduction rate on the price of investment goods caused by each subsidy is calculated by giving weights to the subsidies according to their applied share in total investment.

According to the implementation results, the weights of the said subsidies related with the custom tax and duties are found to be as follows;

Year	Custom Tax Installments	Partial Custom Tax Exemption	Complete Custom Tax Exemption
1965-67	1	—	—
1968-69	.28	.72	—
1970	.20	.12	.68
1971[1.2]	1	—	—
1972-80	.20	—	.80

According to these weights, the total reduction caused by the custom tax installments and the complete or partial custom tax exemptions measures on the price of investment goods are calculated as follows[11]; (table followed on next page)

[11] See Table 4. pp. 46-47

[12] In 1971 only custom tax installments are applied.

Year	Reduction Rate on Price of Investment Goods(per cent)
1965-67	2.646
1968-69	19.965
1970	24.971
1971	2.975
1972	25.555
1973-74	25.511
1975-77	25.555
1978	25.8
1979	25.957
1980	26.062

IV.) Low Interest investment Credit

The subsidy of low interest investment credit was put in effect by 7/1198 numbered decree, and declared with 3.9.1970 dated and 13598 numbered Offical Gazette. THe purpose was to lower the cost of investment credits as well as to direct them according to the economical development targets.

Although 7/1198 numbered decree was agreed in 1970, this subsidy was not applied for a long period of time. It was rearranged by 10.2.1973 dated and 7/5822 numbered decree, and the first one was cancelled. With the new decree, it is agreed to pay approximately six percent of interest difference back to investors for their investments making use of medium term credits and taking place in the general encouragement table of the annual plans.

This subsidy, started being applied after 1973, is included in the

calculation of cost of capiatl services by a six per cent of reduction from normal interest rates.

APPLICATION OF JORGENSON'S THEORY OF INVESTMENT TO TURKISH DATA

We may summarize the empirical specification of the Jorgenson's theory of investment as follows: First, net investment is a distributed lag function may be represented as the ratio of two polynomials in the lag operator. Second, net investment is equal to gross investment less replacement investment and replacement investment is proportional to the accumulated stock of capital. The constant of proportionality is the rate of replacement of capital stock. Two estimates of the rate of replacement are possible, an estimate from the calculation of capital stock and an estimate from a regression with gross investment as dependent variable. Third, the desired level of capital services is proportional to the value of output divided by the implicit rental price of capital services. The constant of proportionality is the elasticity of output with respect to capital services.

In the definition of the desired level of capital services the price of capital services is the weighted sum of the rate of replacement, the cost of capital and the rate of capital gain (loss) with weights given by the tax structure, multiplied by the price of investment goods. Generally for empirical work it is assumed that all capital gains (losses) are treated as transitory by each firm, hence the weight associated with the rate of change of the price of investment goods is zero. The weight for the rate of replacement depends on the tax rate applied to income as defined for tax purposes in section one. Hence, the price of capital services may be defined as; (followed on next page)

$$c_t = \frac{q_t}{1 - u_t}\left[(1 - u_t w_t - u_t k_t)\lambda_t + r_t\right]$$

Where,

- q_t is the price of investment goods,
- u_t is the corparate tax rate,
- w_t is the present value of depreciation,
- k_t is the present value of tax rebates
- λ_t is the rate of replacement,
- r_t is the interest rate.

In this definition tax rebates are taken into account in investment decisions. Capital gains (losses) are assumed to be treated as transitory by each firm. Hence, desired capital is proportional to the value of output divided by the price of capital services excluding capital gains (losses).

Than the complete empirical specification of the Jorgenson's theory of investment behavior can be represented as;

$$I_t = \alpha\mu(s)\left[\frac{p_t Q_t}{c_t} - \frac{p_{t-1} Q_{t-1}}{c_{t-1}}\right] + [1 - w(s)][I_t - \lambda K_t] + \lambda K_t + \beta$$

Where,

- I_t is gross investment,
- p_t is GNP deflater,
- Q_t is GNP,
- c_t is price of capital services,

K_t is capital stock.

The parameters $\{\alpha\ \mu_\tau\}$ and $\{w_\tau\}$ are unknown and have to be estimated. The parameter λ can be estimated from the calculation of capital stock and from the regression with gross investment as a dependent variable. The parameter β is the intercept in the regression.

We have taken the polynomials $\mu(s)$ and $w(s)$ for total gross investment for Turkey as;

$$\mu(s) = \mu\ s + \mu_2 s^2$$

$$w(s) = 1 + w_1 s + w_2 s^2$$

Hence, the investment behavior under the theory of Jogenson used in this paper can be expressed as;

$$I_t = \alpha\mu_1\left[\frac{p_t\ Q_t}{c_t} - \frac{p_{t-1}\ Q_{t-1}}{c_{t-1}}\right] + \alpha\mu_2\left[\frac{p_{t-1}\ Q_{t-1}}{c_{t-1}} - \frac{p_{t-2}\ Q_{t-2}}{c_{t-2}}\right]$$

$$+ w_1[I_{t-1} - \lambda K_{t-1}] - w_2[I_{t-2} - \lambda K_{t-2}] + \lambda K_t + \beta$$

The ordinary least square is applied to yearly data within the period 1958-1980 [13] in order to estimate the unknown parameters of the investment function. The result of the regression for total gross investment is;[14]

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[13] See Data section pp. 67 discussed in section capital services. All investment promotive measures previously covered in the calculation of price of

[14] See the computer output

$$I_t = \underset{(0.004998941)}{-\ 0.022742138}\ \left[\frac{p_t\ Q_t}{c_t} - \frac{p_{t-1}\ Q_{t-1}}{c_{t-1}}\right] + \underset{(0.012366663)}{0.045198266}\ \left[\frac{p_{t-1}\ Q_{t-1}}{c_{t-1}} - \frac{p_{t-2}\ Q_{t-2}}{c_{t-2}}\right] + \underset{(0.1523703)}{0.6912199}\ \left[I_{t-1} - \lambda K_{t-1}\right] - \underset{(0.1438689)}{1.1354843}\ \left[I_{t-2} - \lambda K_{t-2}\right] + \underset{(0.01842588)}{0.21434117}\ K_t - \underset{(1374.877747)}{4126.438232}$$

$R^2 = .9943$ $\quad d = 2.0916$ $\quad F = 593.259$

The coefficient, - 0.022742138, associated with the first lagged change in desired capital services, and so. The coefficient, 0.6912199, associated with the first lagged value of net investment, an so. The coefficient, 0.21434117, associated with the capiatl stock, K_t, is an estimate of λ, the rate of replacement.

Changes in the dependent variable, I_t, has been explained 99.43 per cent by the independent variables. F and t tests are applied and the result showed that all independent variables which were chosen fit to the model and the regression parameters are individually significant. The Durbin-Watson test proved the absence of autoregression of the disturbence in the regression.

Robert E.Hall and Dale W.Jorgenson[15] in their 1967 work suggested that rate of replacement should be approximately equal to 2.5 times of depreciation rate in order to be able to keep the capiatl good in working order for its life time. This rate can be calculated as, $\lambda = 0.08 \times 2.5 = 0.2$,

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[15] "Tax Policy and Investment Behavior"
Dale W.Jorgenson and Robert E.Hall. The American Economic Review, June 1967

for Turkey. In the regression, estimate for λ is found to be 0.21434117, which is very near to the suggested figure.

The empirical resutl showed fairly good evidence on the underlying determinants of investment expenditures. The result suggest that policy instruments that effect the tax structure for business income and the cost of capital play an important role in the determination of investment expenditures in Turkey.

THE EFFECTS OF SUBSIDIES ON INVESTMENT

Subsidies on capital goods had started with the application of the tax rebate for investment in 1963, and extended with the custom tax instalments the custom tax exemptions on imported capital goods and the low interest investment credit. Application periods of these precautions which were taken in order to increase the investment level have been summrized below within the periods 1963-1980;

Subsidy Year	Tax Rebate for investment	Custom Tax Instalments	Custom Tax Exemption	Low Interest Investment credit
1963-64	x			
1965-67	x	x		
1968-70	x	x	x	
1971	x	x		
1972	x	x	x	
1973-80	x	x	x	x

The fixed capital investments and the annual increase rate of investment is shown at Table five, for the periods which is mentioned above(1963-1980) and for the period of eleven years before 1963, in which no subsidies given to capiatl goods investments.

The table five can be summrised and interpreted in the following manner;

Periods	Annual Average Increase Rate of Investment between Two Periods (per cent)
1952-62	3.6
1963-64	4.1

Continued from previous page

1965-67	10.3
1968-70	12.1
1971	-4.7
1972	10.0
1973-77	15.0
1977-80	-4.5
1973-80	7.7
1963-80	7.9

Before the application of subsidies, for the period 1952-62, the annual average increase rate of fixed capiatl investment for the period of eleven years is 3.6 per cent, whereas the rate for the period of eighteen years after the application is 7.9 per cent.

For the period 1963-64, at which only tax rebate for investment had been applied, the annual average increase rate for fixed capital investment was 4.1 per cent. So, there was a very slight increase compare to the previous period.

The average of annual increase in fixed capital investment had been 10.3 per cent in period 1965-67, during which tax rebate for investment and custom tax installments were applied together; had been 12.1 per cent in period 1968-70, during which tax rebate for investment, custom tax installments and custom tax exemptions were applied together; and 7.7 per cent in period 1973-80, during which all of the subsidies adopted in this research were applied together.

After March 12th 1970, custom tax exemptions which were applied in earlier periods, was removed. The effect of this application was 4.7 per cent decrease in fixed capital investments in 1971.

According to these results, a part from crisis period of 1977-80, rate of annual average increased in the periods during which subsidies were applied and additional subsidies brought even higher increases to the rate, whereas removed subsidies caused decrease in the rate of annual average increase in fixed capital investments. The situation mentioned above reflects that, the said subsidies have an effect on investments. However, we can not know how big this effect is and what amount of it results from which of these subsidies at this point. A conclusion in this detail can roughly be arrived by using the investment model which we developed in the earlier sections.

According to the model, which is developed before, any decrease in the cost of capital services will cause an increase in the investment level. For this reason, the method to be used to measure the effects of investment encouraging measures is merely to estimate this increase caused in the level of investment.

To do this, first, the cost of capital services in case if there were not any promotive measure is calculated[16]; than using the coefficients of the investment function, which are determined in the earlier section, with this presently determined cost of capital services variable, the investment levels in case if there were not any promotive measures are estimated.

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[16] See Table 6 pp.50-51.

The difference between the actual gross investment level and the estimated gross investment level in case if there were not any susidy is the amount of increas caused by the promotive measures in gross investment[17]. Then, the cost of capital services are calculated seperately in the case of only tax rebates for investment[18], only custom tax installments[19], only complete and partial custom tax exemptions[20] and only low interest investment credits[21] are to be applied. The weights are given to the each promotive measure according to the difference between the costs of capital services [22] in case of no subsidy and only when that promotive measure is applied.

The amount of increase caused by the promotive measures is distributed among the subsidies according to the given weights in order to obtain the individual effects of each promotive measure[23].

From Table 7 and Table 13 we could obtain the following results about the effects of the promotive measures;

Within the period 1963-1980, the total amount of increase on fixed capital investment caused by the all promotive measures is 11.1 per cent. 1.3 per

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[17] See Table 7,pp.52-53

[18] See Table 8,pp.54-55

[19] See Table 9,pp.56-57

[20] See Table 10, pp.58-59

[21] See Table 11, pp.60-61

[22] See Table 12, pp62-63 Six different sets of the cost of capital services under six different assumptions are given altogether

[23] See Table 13, pp.64-66

cent of this increase caused by the tax rebates for investment, 0.7 per cent by the custom tax installments, 5.4 per cent by the custom tax exemptions and 3.7 per cent by the low interest investment credits.

In order to compare the promotive measures efficiently the period 1973-1980 has choosen. Since within the given period all the promotive measures are applied together. The total amount of increase caused by the all promotive measures on fixed capital investment is 13.3 per cent. 0.7 per cent of this increase caused by the tax rebates for investment, 0.2 per cent by the custom tax installments, 6.7 per cent by the custom tax exemptions and 5.7 per cent by the low interest investment credit. These results reflect that, within the period 1973-1980, 93 per cent of the increase on fixed capital investment resulted from the custom tax exemptions and the low interest investment credits and only seven per cent of the increase caused by the tax rebates for investmet and the custom tax installments.

CONCLUSİON

According to the obtained results, the custom tax installments measure has the least effect on fixed capital investment.

Another subsidy which has a little effect on fixed capital investment is tax rebates for investmenet. This result should not be regarded as unexpected. Since, this promotive measure related with income and corporation tax may have a beter effect in a effectively applied taxation system in which avoiding from tax is at minimum. In a society like Turkish, where avoiding from tax is common, it is not possible to obtain good results out of this subsidy. Moreover, the encouraging effects of tax rebates on fixed capital investment are not felt at the beginning of the investment but after the investment is completed and consequently after some profit is gained from this investment

The application of the low interest investment credits has been very effective, 43 per cent of the increased on fixed capital investment caused by this promotive measure during the period in which this subsidy is applied.

The most effective promotive measure on fixed capital investment has been the complete and partial exemptions for custom taxes. The reason for that is, imported machinery and equipment have a great share in total investment and this subsidy is felt by the private investor at the beginning of the investment.

TABLE 1

Year	Price of investment goods (q)	Price of investment goods after below subsidies applied: Custom Tax installments (rate of discount) +	Custom Tax exemptions
1956	0.37761		
1957	0.41651		
1958	0.52371		
1959	0.68661		
1960	0.69458		
1961	0.70077		
1962	0.73322		
1963	0.76057		
1964	0.79566		
1965	0.85682	0.02646*	0.83415
1966	0.91709	" *	0.89282
1967	0.97568	" *	0.94986
1968	1.00000	0.19965	0.80035
1969	1.04914	"	0.83968
1970	1.12533	0.24971	0.84432
1971	1.39130	0.02975 *	1.34991
1972	1.59343	0.25555	1.18623
1973	1.78615	0.25511	1.33049
1974	2.15637	"	1.60626
1975	2.54665	0.25555	1.89585
1976	3.06730	"	2.28345
1977	3.92737	"	2.92373
1978	5.47930	0.25800	4.06564
1979	8.76759	0.25957	6.49179
1980	16.35779	0.26062	12.09462

* Only custom tax installments

TABLE 1 - continued

Interest rate (R)	Expenditure Tax (e) Rate		Low interest Investment Credit (ṙ)	Interest rate (r) (R+e)
0.07	0.10	0.007	(r-0.06)	0.077
"	0.15	0.0105	after 1973	0.0805
"	"	"		"
"	"	"		"
"	"	"		"
0.12	"	0.018		0.138
0.105	"	0.01575		0.12075
"	0.20	0.021		0.126
"	"	"		"
"	"	"		"
"	"	"		"
"	"	"		"
"	"	"		"
"	"	"		"
"	0.25	0.02625		0.13125
0.115	"	0.02875		0.14375
"	"	"		"
0.105	"	0.02625	0.07125	0.13125
"	"	"	"	"
0.115	"	0.02875	0.08375	0.14375
"	"	"	"	"
"	"	"	"	"
0.16	"	0.04	0.14	0.20
0.19	"	0.0475	0.1775	0.2375
0.21	"	0.0525	0.2025	0.2625

TABLE 1 - continued

Tax Rate (U)	Present value of depreciation (W)	Tax rebate for investment (i)	$q/1-U$
0.28	0.395		0.52445.8
"	0.379		0.57848.6
"	"		0.72737.5
"	"		0.95362.5
0.36	"		1.08528.1
"	0.198		1.09495.3
"	0.240		1.14565.6
"	0.226	0.160446	1.18839.1
"	"	"	1.24321.9
"	"	"	1.30336
"	"	"	1.39503
"	"	"	1.48416
0.40	"	"	1.33392
"	"	"	1.39947
"	0.214	0.158194	1.40720
"	0.186	0.152832	2.24985
"	"	"	1.97705
0.424	0.214	0.158194	2.30989
"	"	"	2.78865
"	0.186	0.152832	3.29141
"	"	"	3.96432
"	"	"	5.07592
"	0.102	0.1287	7.05840
"	0.069	0.112612	11.27047
"	0.054	0.101887	20.99760

TABLE 1 - continued

1 - uw	ui	$K_t - K_{t-1} = \lambda (I_t - K_{t-1})$	(1 - uw - ui) λ
0.8894	0	0.0880	0.07827
0.8939	0	0.1107	0.09895
"	0	0.1023	0.09145
"	0	0.1085	0.09699
0.8636	0	0.1188	0.10259
0.9287	0	0.1079	0.10021
0.9136	0 [62]	0.1129	0.10315
0.9186	0.05776	0.1124	0.09676
"	0.05776	0.1051	0.09047
"	0.05776	0.1091	0.09392
"	0.05776	0.1313	0.11303
"	0.05776	0.1156	0.09951
0.9096	0.06418	0.1323	0.11185
"	0.06418	0.1235	0.10441
0.9144	0.06328	0.1179	0.10035
0.9256	0.06113	0.0934	0.08074
"	0.06113	0.1193	0.10313
0.9093	0.06707	0.1327	0.11176
"	0.06707	0.1274	0.10730
0.9211	0.06480	0.1496	0.12810
"	0.06480	0.1328	0.11372
"	0.06480	0.1180	0.10104
0.9567	0.05457	0.0889	0.08020
0.9707	0.04775	0.1013	0.09349
0.9771	0.04320	0.0915	0.08545

TABLE 1 - continued

$(1-uw-ui)\ \lambda + \dot{r}$	C Price of capital services
0.15527	0.08143
0.17945	0.10381
0.17195	0.12507
0.17749	0.16926
0.18309	0.19870
0.23821	0.26083
0.22389	0.25650
0.22276	0.26473
0.21647	0.26912
0.21992	0.28663
0.23903	0.33345
0.22551	0.33469
0.23785	0.31727
0.23041	0.32245
0.23159	0.32589
0.22449	0.50507
0.24688	0.48809
0.18301	0.42273
0.17855	0.49791
0.21185	0.69729
0.19747	0.78283
0.18479	0.93798
0.22020	1.55426
0.27099	3.05418
0.28795	6.04626

TABLE 2

Calculation of the present value of tax rebate for investment.

Tax rebate rate : 40 per cent

Investment amount : 15.989.597.400 TL.

Net capital : 8.574.229.400 TL.

Net cap./ Invest. amount ratio : 0.5362

For 100 unit of investment, reduction rate is (53.62 x 0.4 = 21.45

For the calculation of the present value of tax rebate, it is assumed that investors make use of this subsidy, in three years after their investments completed, in three equal parts and at the end of the years.

Year (interest rate)	Nominal Value	1963-69 (0.126) Present Value	1970/73-74 (0.13125) Present Value
1	7.15	6.2491	6.2116
2	7.15	5.3482	5.2731
3	7.15	4.4473	4.3347
Total	21.45	16.0446	15.8194

TABLE 2 - continued

1971-72/75-77 (0.14375) Present Value	1978 (0.2) Present Value	1979 (0.2375) Present Value	1980 (0.2625) Present Value
6.1222	5.7200	5.4519	5.2731
5.0944	4.2900	3.7537	3.3962
4.0666	2.8600	2.0556	1.5194
15.2832	12.8700	11.2612	10.1887

TABLE 3

Calculation of present value of the reduction caused by custom tax installments.

Investment amount : 13.509.286.882 TL.

Installed investment : 938.300.000 TL.

Installed invest./Invest. amount ratio : 0.069456

For one unit of investment, installment rate is 0.07 TL.

Forthe calculation of the present value of the reduction caused by custom tax installments, it is assumed that installments were applied in five equal parts and collected at the end of the year.

Rate of amount in hand	Amount	1965–69 (0.126)	1970/73–74 (0.13125)	Year (interest rate)
% 100	7	0.882	0.91875	
% 80	5.6	0.7056	0.735	
% 60	4.2	0.5292	0.55125	
% 40	2.8	0.3528	0.3675	
% 20	1.4	0.1764	0.18375	
		2.646	2.75625	Total

TABLE 3 - continued

1971-72/75-77 (0.14375)	1978 (0.2)	1979 (0.2375)	1980 (0.2625)	Year (interest rate)
0.9625	1.4	1.6625	1.8375	
0.805	1.12	1.33	1.47	
0.60375	0.84	0.9975	1.1025	
0.4025	0.56	0.665	0.735	
0.20125	0.28	0.3325	0.3675	
2.975	4.2	4.9875	5.5125	Total

TABLE 4

Calculation of total reduction on price of investment goods caused by combined effec of custom tax installmens and complete or partial custom tax exemptions

Year	Custom Tax Installments Weight	Reduction Rate
1965-67	1	0.02646
1968-69	0.28	0.02646
1970	0.20	0.02756
1971	1	0.02975
1972	0.20	0.02975
1973-74	0.20	0.02756
1975-77	0.20	0.02975
1978	0.20	0.042
1979	0.20	0.04987
1980	0.20	0.05512

TABLE 4 - continued

Custom Tax Exemptions Weight	Reduction Rate	Combined reduction rate on price of inv. goods (per cent)
—	—	0.02646
0.72	0.267	0.19965
0.80	0.312	0.24971
—	—	0.02975
0.80	0.312	0.25555
0.80	0.312	0.25511
0.80	0.312	0.25555
0.80	0.312	0.258
0.80	0.312	0.25957
0.80	0.312	0.26062

TABLE 5

Annual increase rate of investments

Year	Investment with 1968 prices, million TL.	Annual increase rate of investment (per cent)
1952	8561	—
1953	9739	13.8
1954	9351	-4.0
1955	9672	3.4
1956	8914	-7.8
1957	9378	5.2
1958	9364	-0.1
1959	9745	4.1
1960	10821	11.0
1961	11192	3.4
1962	11946	6.7
1963	12706	6.4
1964	12917	1.7
1965	13478	4.3

TABLE 5 - continued

Year	Investment with 1968 Prices, million TL.	Annual increase rate of investment (per cent)
1966	16044	19.0
1967	17274	7.7
1968	20256	17.3
1969	22503	11.1
1970	24297	8.0
1971	23146	-4.7
1972	25463	10.0
1973	29906	17.4
1974	33837	13.1
1975	41899	23.8
1976	47588	13.6
1977	50854	6.9
1978	47645	-6.3
1979	47322	-0.7
1980	44193	-6.6

TABLE 6

Cost of capital services in case if there were not any subsidy

Year	q	$q/(1-U)$
1962	0.73322	1.14565
1963	0.76057	1.18839
1964	0.79566	1.24321
1965	0.85682	1.33878
1966	0.91709	1.43295
1967	0.97568	1.52450
1968	1.0	1.66667
1969	1.04914	1.74856
1970	1.12533	1.87555
1971	1.39130	2.31883
1972	1.59343	2.66571
1973	1.78615	3.10095
1974	2.15637	3.74369
1975	2.54665	4.42126
1976	3.06730	5.32517
1977	3.92737	6.81835
1978	5.47930	9.51267
1979	8.76759	15.22151
1980	16.35779	28.39894

TABLE 6 - continued

$(1-uw)\lambda + r$	C_5
0.22389	0.25650
0.22925	0.27244
0.22255	0.27668
0.22622	0.30286
0.24661	0.35338
0.23219	0.35397
0.24634	0.41057
0.23834	0.41675
0.23906	0.44837
0.23020	0.53379
0.25417	0.67501
0.25191	0.78116
0.24709	0.92503
0.28155	1.24481
0.26607	1.41687
0.25244	1.72122
0.28505	2.71159
0.33583	5.11184
0.35190	9.99359

TABLE 7

The effect of susidies on gross investment

(with 1968 prices, million TL.)

Year	The Actual Gross Investment
1963	12706
1964	12917
1965	13478
1966	16044
1967	17274
1968	20256
1969	22503
1970	24297
1971	23146
1972	25463
1973	29906
1974	33837
1975	41899
1976	47588
1977	50854
1978	47645
1979	47322
1980	44193
Total	531328

TABLE 7 - continued

Level of Gross Investment - if there lere not any subsidy	Investment amount caused by subsidies
12693.426	12.574
12208.928	708.072
12699.366	778.634
14371.383	1672.617
15329.605	1944.395
19722.53	533.47
19545.54	2957.46
22612.361	1684.639
21700.883	1445.117
23770.994	1692.006
25443.113	4462.887
30425.129	3411.871
39068.102	2830.898
37934.632	9653.368
43128.864	7725.136
41035.133	6609.867
39724.357	7597.643
41860.701	3332.299
472275.047	59052.953

TABLE 8

Costof capital services in case if there was only tax rebate for investments.

Year	q	$q/1-U$
1963	0.76057	1.18839
1964	0.79566	1.24321
1965	0.85682	1.33878
1966	0.91709	1.43295
1967	0.97568	1.52450
1968	1.0	1.66667
1969	1.04914	1.74856
1970	1.12533	1.87555
1971	1.39130	2.31883
1972	1.59343	2.65571
1973	1.78615	3.10095
1974	2.15637	3.74369
1975	2.54665	4.42126
1976	3.06730	5.32517
1977	3.92737	6.81835
1978	5.47930	9.51267
1979	8.76759	15.22151
1980	16.35779	28.39894

TABLE 8 - continued

$(1-uw-ui)\ \lambda + \dot{r}$	C_1
0.22276	0.26473
0.21647	0.26912
0.21992	0.29442
0.23903	0.34252
0.22551	0.34379
0.23785	0.39642
0.23041	0.40289
0.23159	0.43436
0.22449	0.52055
0.24688	0.65564
0.18301	0.75356
0.17855	0.89306
0.21185	1.20192
0.19747	1.37107
0.18479	1.66906
0.22020	2.66545
0.27099	5.03817
0.28795	9.88141

TABLE 9

Cost of capital services in case if there wasonly custom tax installments.

Year	Rate		Weight	Discount Rate
1965	0.02646	x	1.00	0.02646
1966	"		"	"
1967	"		"	"
1968	"	x	0.28	0.00741
1969	"		"	"
1970	0.02756	x	0.2	0.00551
1971	0.02975	x	1.0	0.02975
1972	"	x	0.2	0.00595
1973	0.02756	x	"	0.00551
1974	"		"	"
1975	0.02975	x	0.2	0.00595
1976	"		"	"
1977	"		"	"
1978	0.042		"	0.0084
1979	0.04987		"	0.00997
1980	0.05512		"	0.01102

TABLE 9 – continued

q	$q/1-U$	$(1-uw)\lambda + r$	C_2
0.83415	1.30336	0.22622	0.29485
0.89282	1.39503	0.24661	0.34403
0.94986	1.48416	0.23219	0.34461
0.99256	1.65427	0.24634	0.40751
1.04137	1.73562	0.23834	0.41367
1.11913	1.86522	0.23906	0.44590
1.34991	2.24985	0.23020	0.51792
1.58395	2.63992	0.25417	0.67099
1.77631	3.08387	0.25191	0.77686
2.14449	3.72307	0.24709	0.91993
2.53150	4.39497	0.28155	1.23740
3.04905	5.29349	0.26607	1.40844
3.90400	6.77778	0.25244	1.71098
5.43327	9.43276	0.28505	2.66681
8.68018	15.06976	0.33583	5.06088
16.17753	28.08599	0.35190	9.88346

TABLE 10

Cost of capital services in case if there wasonly custom tax exemptions.

Year	Rate		Weight	Discount Rate
1968	0.267	x	0.72	0.19224
1969	"	x	"	"
1970	0.312	x	0.8	0.2496
1971	———	x	———	———
1972	0.312	x	0.8	0.2496
1973	"	x	"	"
1974	"	x	"	"
1975	"	x	"	"
1976	"	x	"	"
1977	"	x	"	"
1978	"	x	"	"
1979	"	x	"	"
1980	"	x	"	"

TABLE 10 - continued

q	$q/1-U$	$(1-uw)\lambda + r$	C_s
0.80776	1.34627	0.24634	0.33164
0.84745	1.41242	0.23834	0.33664
0.84445	1.40742	0.23906	0.33646
1.39130	2.31883	0.23020	
1.19571	1.99285	0.25417	0.50652
1.34033	2.32696	0.25191	0.58618
1.61814	2.80927	0.24709	0.69414
1.91101	3.31773	0.28155	0.93411
2.30170	3.99601	0.26607	1.06322
2.94710	5.11650	0.25244	1.29161
4.11167	7.13832	0.28505	2.03478
6.57920	11.42222	0.33583	3.83592
12.27489	21.31057	0.35190	7.49919

TABLE 11

Cost of capital services in case if there was only low interest

Year	q	$q/1-U$
1973	1.78615	3.10095
1974	2.15637	3.74369
1975	2.54665	4.42126
1976	3.06730	5.32517
1977	3.92737	6.81835
1978	5.47930	9.51267
1979	8.76759	15.22151
1980	16.35779	28.39894

TABLE 11 - continued

$(1-uw)\ \lambda + \dot{r}$	C_4
0.25191	0.59510
0.24709	0.70041
0.28155	0.97953
0.26607	1.09736
0.25244	1.31212
0.28505	2.14083
0.33583	4.19855
0.35190	8.28965

TABLE 12

Year	C	C_1	C_2
1962	0.25650		
1963	0.26473	0.26473	
1964	0.26912	0.26912	
1965	0.28663	0.29442	0.29485
1966	0.33345	0.34252	0.34403
1967	0.33469	0.34379	0.34461
1968	0.31727	0.39642	0.40751
1969	0.32245	0.40289	0.41367
1970	0.32589	0.43436	0.44590
1971	0.50507	0.52055	0.51792
1972	0.48809	0.65564	0.67099
1973	0.42273	0.75356	0.77686
1974	0.49791	0.89306	0.91993
1975	0.69729	1.20192	1.23740
1976	0.78283	1.37107	1.40844
1977	0.93798	1.66906	1.71098
1978	1.55426	2.66545	2.68881
1979	3.05418	5.03817	5.06088
1980	6.04626	9.88141	9.88346

TABLE 12 - continued

C_3	C_4	C_5
		0.25650
		0.27244
		0.27668
		0.30286
		0.35338
		0.35397
0.33164		0.41057
0.33664		0.41675
0.33646		0.44837
		0.53379
0.50652		0.67501
0.58618	0.59510	0.78116
0.69414	0.70041	0.92503
0.93411	0.97953	1.24481
1.06322	1.09736	1.41687
1.29161	1.31212	1.72122
2.03478	2.14083	2.71159
3.83592	4.19855	5.11184
7.49919	8.28965	9.99359

C :all subsidies included.
C_1 :only tax rebate for investment.
C_2 :only custom tax installments.
C_3 :only custom tax exemptions.
C_4 :only low interest investment credit.
C_5 :no subsidy.

$C = {}^{9/}1-U_t[(1-U_tW_t-U_ti_t)\lambda_t+r_t]$

capital gains(losses) not included in the calculation of price of capital services

TABLE 13

Year	Tax Rebate for investment Weights	Amount
1963	1	12.574
1964	1	708.072
1965	0.513	399.494
1966	0.537	898.794
1967	0.556	1080.662
1968	0.147	78.517
1969	0.143	422.363
1970	0.109	183.829
1971	0.455	657.278
1972	0.101	170.805
1973	0.067	298.29
1974	0.065	221.441
1975	0.068	193.871
1976	0.063	607.823
1977	0.058	447.163
1978	0.035	231.661
1979	0.032	241.9
1980	0.025	84.562
Total		6939.089

TABLE 13 - continued

Custom Tax Installments		Custom Tax exemptions	
Weights	Amount	Weights	Amount
—	—	—	—
—	—	—	—
0.487	379.140	—	—
0.463	773.823	—	—
0.444	863.733	—	—
0.032	16.980	0.821	437.974
0.032	98.859	0.825	2441.237
0.019	32.409	0.872	1468.4
0.545	787.839	—	—
0.021	35.449	0.878	1485.752
0.01	46.473	0.472	2107.264
0.01	35.326	0.469	1599.267
0.012	33.495	0.496	1404.42
0.012	111.877	0.486	4693.374
0.011	87.787	0.477	3683.01
0.017	114.374	0.514	3398.15
0.022	167.33	0.551	4189.566
0.025	83.016	0.564	1880.287
	3662.91		28788.701

TABLE 13 - continued

Low Interest Investment Credit Weights	Amount	Total
—	—	12.574
—	—	708.072
—	—	778.634
—	—	1672.617
—	—	1944.395
—	—	533.47
—	—	2957.46
—	—	1684.639
—	—	1445.117
—	—	1692.006
0.451	2010.861	4462.887
0.456	1555.838	3411.871
0.424	1999.113	2830.898
0.44	4240.294	9653.368
0.454	3507.178	7725.136
0.434	2865.687	6609.867
0.395	2998.847	7597.643
0.385	1284.435	3332.299
	19662.253	59052.953

DATA

I_t Gross investment. (Türkiye Milli Geliri ve Harcamaları 1960-1980 DİE. Türkiye Yatırım Hesapları, Kaynak ve Yöntemler 1960-1980 DİE. 1963-1980 Yıllık ProgramlarDPT.)

P_t GNP deflater. (Türkiye Milli Geliri ve Harcamaları 1960-1980 DİE. 1980 yılı Programı DPT)

K_t Capital stock. (DİE. bülteninde bulunan sadece 1968,1969,1970, 1971 yıllarına ait amortisman miktarlarından ve amortisman oranından hareketle, sermaye stoku sabit 0.08 amortisman oranına göre, 1956-1980 yılları için hesaplanmıştır.)

Q_t GNP (Türkiye Milli Geliri ve Harcamaları 1960-1980 DİE. 1980 yılı Programı,DPT.)

λ Rate of replacement. ($K_t - K_{t-1} = I_t - \lambda K_{t-1}$, kapital stoku formülünden yıllara göre hesaplandı)

q_t Investment goods price index (Yatırım Deflatörü Türkiye, Yatırım Hesapları. Kaynak ve Yöntemler 1960-1980 DİE.)

u_t Corporate income tax rate (1961-1972 Vergi Kanunları)

1.1.1961	192 S.K	%20 1960 kazançlarına
31.1.1969	1137 S.K	%25 1968 kazançlarına
26.6.1972	1598 S.K	%3 Mali denge 1973 kazançlarına

Vergi Yükü

	1950-60	1960-68	1968-73	1973-80
Vergi	10	20	25	25
M.D.	—	—	—	3
100 -(Vergi + M.D.) x 0.2	18	16	15	14.4
	28	36	40	42.4

r_t Interest rate (T.C. Merkez Bankası Aylık Bültenler, ödünç para verme işlerinde ve mevduat kabul edilmesinde uygulanan genel faiz oranlarına gider vergileri eklenerek bulundu.)

W_t Depreciation Rate (İstanbul İmalat Sanayi 1969-70 İstanbul Sanayi Odası., Kamu İktisadi Kuruluşları Ekonomik hesapları, DİE. ile desteklenip, Türkiye Sinaî Kalkınma Bankası A.Ş. araştırma gurubunun önerisi ile sözkonusu dönemler için 0.08 olarak sabit alınmıştır.)

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