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# Tax Policy Options to Promote Private Capital Formation in Pakistan

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and
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In Pakistan, at least, changes in corporate tax rates are probably better instruments for promoting capital formation than are increased investment tax credits. Increasing the investment tax credit stimulates more capital formation than does decreasing corporate taxes, but the tax credits also increase inflation.

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This paper — a product of the Public Economics Division, Country Economics Department — is part of a series of PRE discussion papers evaluating the tax incentives for industrial and technological development. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Ann Bhalla, room N10-053, extension 37699 (27 pages).

Feltenstein and Shah developed a simple two-period general equilibrium model to analyze the macroeconomic impact of tax policies in Pakistan. They analyze two scenarios.

In scenario 1, the investment tax credit rate is increased from 15 percent to 30 percent. The new fiscal regime increases investment but also significantly increases inflation.

In scenario 2, the original investment tax credit rate is retained but the statutory corporate tax rate is reduced. Welfare improves more than under scenario 1.

Feltenstein and Shah conclude that in Pakistan, at least, changes in corporate tax rates are probably better instruments for promoting capital formation than are increased investment tax credits.

In particular, cuts in corporate taxes improve welfare more than do increases in investment tax credits.

Increasing the investment tax credit stimulates more capital formation than does decreasing corporate taxes, but the tax credits also have significant macroeconomic consequences.

Table of Contents

# GENERAL EQUILIBRIUM EFFECTS OF TAXATION ON INVESTMENT IN A DEVELOPING COUNTRY: THE CASE OF PAKISTAN

Andrew Feltenstein and Anwar Shah*

## I. Introduction

Tax incentives are frequently employed by developing nations to stimulate private investment and foster economic growth. The impact of such policies in meeting stated policy objectives in developing countries has received serious research attention only in recent years. Recent attempts to quantify these impacts, while credible, are set exclusively in a partial equilibrium framework (see Shah and Baffes (1990), Bernstein and Shah (1991a, 1991b, 1991c), and Rajagopal and Shah (1990a, 1990b) for application of dynamic duality to this question). Analysis of such policies in a partial equilibrium framework are woefully inadequate as these do not capture the intersectoral impacts of such policies. A partial equilibrium framework is not able to capture complex interactions among various sectors of the economy and other taxes in the economy. A large majority of these interactions are simply assumed away in such analyses. In addition, these analyses usually do not consider the interaction between tax credits and the government budget deficit and therefore cannot evaluate possible financial crowding out that may be brought about by the interest rate implications of increased budget deficits. If these interest rate implications are sufficiently strong, their negative impact on investment may outweigh the positive effects of the tax credits on private investment (see Pereira (1990) and Feltenstein and Morris, (1990)).

An applied general equilibrium model can provide a disaggregated view of the economy and thereby yield quantitative estimates of all important interactions. It thus appears to be a more

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valuable tool for assessing the relative merits of alternative incentives policies. (For developed country applications using general equilbrium analysis see e.g. Hamilton, Shah and Whalley (1985), Goulder and Summers (1989), Sen and Turnovsky (1990)). This paper specifies a dynamic general equilibrium framework to evaluate the cost effectiveness of incentives for industrial and technological development offered through the tax code in Pakistan. The applied dynamic general equilibrium model employed in this paper enables us to estimate adjustment effects on factor use and output with a tax incentive policy change. Detailed calculations are presented showing percent change in output, use of capital by sector, changes in tax revenue paid by each sector and impacts on macroeconomic aggretates. Welfare gains and losses of urban and rural consumers associated with proposed policy changes are also estimated.

The remainder of the paper is organized as follows. Section II provides a summary view of the corporate tax regime and investment incentives in Pakistan. Section III outlines the model structure and details procedures used in evaluating policy changes. Section IV presents the benchmark simulation for Pakistan. Section V carries out policy simulations of alternative incentives strategies. Finally, Section VI discusses overall conclusions of this paper and also draws policy implications.

The paper concludes that the investment tax credit offers a greater degree of investment stimulation than an equal yield corporate tax rate reduction. Aggregate welfare, however, is higher under a tax rate reduction alternative. Thus from aggregate consumer welfare viewpoint, corporate tax rate reduction appears to be a superior policy alternative in Pakistan.

## II. Corporate Tax Incentives in Pakistan

Pakistan has followed a stable coporate tax rate regime since the early 1960s. Corporate income tax rate at 30% and a super tax at 25% have been maintained consistently during the last two

decades. Only in the fiscal year 1989-90, was the super tax rate brought down to 15%. Foreign direct investment receives tax treatment equivalent to domestic investment. Losses are allowed to be carried forward six years but no carryback of such losses is permitted. A sales tax at 12.5% is payable on all domestically manufactured goods by the producer and on imported goods by the importer. Currently (1989-90), import duties at differential rates are imposed on imported machninery and equipment. These rates vary from 20 to 50% if similar machinery is not manufactured in Pakistan and a higher rate of 80% applies to imported machinery with domestic substitutes. Businesses are further subject to a large number of miscellaneous licensing fees and charges.

The regime of fiscal incentives through the corporate income tax has experienced significant changes over time. From time to time, Pakistan has relied upon a variety of fiscal incentives to stimulate investment. These include accelerated capital consumption allowances for certain physical assets, full expensing for R&D investments, tax rebates, regional and industry specific tax holidays and investment tax credits. These are briefly discussed below:

Tax Holidays: Tax holidays for two years for specific industries (e.g. engineering goods) and specific regions (most of the country except major metropolitan areas) was introduced in 1959-60. The holiday period was subsequently raised to four years in 1960-61. These tax holidays were eliminated in 1972-73 but reinstated again in 1974-75. Presently tax holidays for five years are permitted to engineering goods, poultry farming and processing, dairy farming, cattle or sheep breeding, fish farming, date processing and manufature of agricultural machinery industries and also to all industries in designated areas of the country.

Investment tax credits: Industries are eligible for varying tax credits according to location. A general tax credit for modernization and replacement of plant and equipment was introduced in 1974/75 at 15% rate but its application was restricted to designated areas. Since 1976-77, the credit

was made available regardless of location and type of industry. This credit was withdrawn in 1989-90 and reinstated in 1990-91.

Tax rebates: Companies exporting goods manufactured in Pakistan are entitled to a rebate of 55% of taxes attributable to such sales.

Accelerated Capital Consumption Allowances: Capital consumption allowances follow accelerated schedules for machinery and equipment, transport vehicles and housing for workers (25%), oil exploration equipment (100%), ship building (20-30%), and structures (10%) on a declining balance method. Expenditures relating to research and development, transfer and adaptation of technologies and royalties are eligible for full expensing.

Of the incentives numerated earlier, only the two general incentives, namely, investment tax credit for physical investment and a corporate tax rate reductions are the subjects of investigation in this paper. Since these two types of incentives are widely used in both the developed and the developing worlds, an evaluation of their impacts are expected to yield lessons of general interest to policy makers in Pakistan and elsewhere. The following sections present an empirical examination of this issue.

## III. The Model Structure

The general structure of our model is a two period general equilibrium system. All agents have perfect foresight, and hence in period 1 correctly anticipate the prices of period 2. We need to specify the behavior of production, consumption, and government production, taxation, and deficit financing. We need also specify the exchange rate regime and the characteristics of the trade account. A solution is found for both periods simultaneously, so that we will be determining outcomes for those two years, and hence corresponding rates of change. Our first goal will be to

show that our model specification and estimation yields reasonably accurate replication of Pakistani reality. Let us now turn to a brief description of the structure of the macro model.

## 1. Production

An input-output matrix is used to determine intermediate and final production. Because the model incorporates perfect foresight in both production and consumption, this matrix may be thought of as being replicated in each of two years. Corresponding to each sector in the input-output matrix, value added is produced using capital, land, urban labor, and rural labor. The technology that produces this value added is sector-specific, so that, for example, agriculture would have a higher relative share of land in value added than would textiles. The model uses a seven sector input-output disaggregation of Pakistan's economy with the following structure.

Table 1. Aggregate Input-Output Sectors

| Aggregate Sector | Corresponding Dissaggregated Sectors [1] |
|---|---|
| 1. Agriculture | 1-11 |
| 2. Mining | 12 |
| 3. Food production | 13-24 |
| 4. Textiles | 25-31 |
| 5. Other manufacturing | 32-66 |
| 6. Services and government | 67-87 |
| 7. Imports | |

Here we treat imports as a single product that is distinct from domestic production.[2] The sectoral inputs of real value added are taken from Ahmad et al. (1985), Table 1, column 2. In order to estimate the coefficients in sector-specific Cobb-Douglas production functions for value added, we have used data from Pakistan, Sixth Plan Progress and Future Prospects (1987). Table V.3 gives elasticities of sectoral output with respect to labor inputs for a group of sectors broadly similar to the

aggregation given in Table .. The elasticities are representative of the period 1979-85. Since shares must sum to 1.0, we immediately can obtain the share of labor in each sector. Finally, each sector pays profit taxes as well as withholding taxes on inputs of labor, corresponding to income taxes.

We suppose that there is sector-specific capital, which is produced via investment technologies that use inputs of sectoral capital and non sector-specific labor to produce new capital. The investment in each industry is carried out by the private sector, and since the capital that is produced in one period becomes available only in the next period, the investment firm must pay for the input cost of its production in the current period, but will receive the revenue from that capital in the next period. We will assume that investment is entirely debt financed, so that the investor sells bonds to pay his factors of production. Accordingly, the investor equates the cost of borrowing given by the interest rate, with the anticipated future returns on capital.

Suppose, then, that the rental price of capital in sector j in period i + 1 is $P_{Kj(i+1)}$. If $C_{Hji}$ is the cost-minimizing cost of producing the quantity of capital, $H_{ji}$, then future debt obligations must be equal to the return on new capital. Hence, in the absence of any taxes we would have:

$$C_{Hji} = P_{Kj(i+1)}H_{ji}/(1 + r_i) \tag{1}$$

where $r_i$ is the interest rate in period i, given by:

$$r_i = 1/P_{Bi} \tag{2}$$

where $P_{Bi}$ is the price of a bond in period i.

The investor is affected by several fiscal parameters in making his decision. He receives an investment tax credit as well as a depreciation allowance. He also pays a capital, or profit tax, on the returns to his investment. Let us define the following notation.

$k_{ji}$ = Investment tax credit in sector j in period i (percent).

$d_{ji}$= Depreciation allowance in sector j in period i (percent).[3]

$t_{kji}$= Profit (capital) tax rate in sector j (percent)

$C_{Hji}$= The cost of producing the quantity $H_{ji}$ of capital in sector j.

$r_i$= The interest rate in period i.

$p_{Kji}$= The return to capital in sector j in period i.

$P_{Mi}$= The price of money in period i.

Suppose, then, that the rental price of capital in period i+1 is $P_{Ki+1}$. If $C_{Hi}$ is the cost-minimizing cost of producing the quantity of capital, $H_i$, then future debt obligations must be equal to the return on new capital. Hence:

$$C_{Hji}(1 - k_{ji} - d_{ji}) = \frac{1 - t_{kj(i+1)}\, P_{kj(i+1)}\, H_{j+1}}{1 + r_i}$$

where $r_i$ is the interest rate in period i, given by

$$r_i = 1/P_{Bi}$$

where $P_{Bi}$ is the price of a bond in period i.[4]

Hence the level of private investment depends on both the current interest rate and the perfectly anticipated future return on capital. As we shall see, the government finances its budget deficit by the sale of bonds, as well as monetization and foreign borrowing. Government and private bonds are viewed as being identical. Thus government policies that affect the supply of bonds, such as reductions in spending, will have an immediate impact on interest rates and hence on private investment.

Given the available data, we were not able to directly estimate the shares of capital and labor in investment. Accordingly, we have used the shares of capital and labor in Pakistani GDP as proxies for their shares in investment.[5] We also need the elasticities of investment with respect to the interest rate and with respect to public investment. For these figures we have used a recent paper (Burney 1988)[6], in which aggregate and sectoral investment is estimated as a function of, among other things, change in GDP, public investment, and the real and nominal interest rates. We are thus implicitly assuming that governmental development spending has an impact on private capital formation.

All sectors in the economy pay both income and profit taxes, while certain sectors, in particular agriculture, may receive subsidies. Along with its spending on subsidies, transfer payments, and interest obligations, to be discussed shortly, the government produces public goods using capital of the manufacturing sector and labor as inputs to production. These goods are divided between those used for development, represented by capital expenditures, and those which are represented by current expenditure, and which have no direct impact on private output.[7] The government's target for the output of public goods is determined exogenously in each time period in terms of constant rupees. An attempt to model an optimizing government is thus not made.

## 2. Consumption

There are two types of consumers, representing rural and urban labor. We suppose that both consumer classes have the same demand patterns for goods, and that their demands for the seven different types of goods are given by constant fractions of their incomes.[8] In order to estimate these parameters we have again relied upon Ahmad et al. (1985). Table 2 in Ahmad gives sectoral gross outputs and that portion of gross output that goes to intermediate production. By taking differences we may obtain an estimate of sales to final demand.[9]

The consumers maximize intertemporal utility functions, which have as arguments the levels of consumption and leisure in each of the two periods. We permit rural-urban migration in that rural workers can choose to become urban labor if the relative wage is favorable. The consumers maximize these utility functions subject to intertemporal budget constraints. The consumer saves by holding money, domestic, bonds, and possibly foreign currency. He requires money for transactions purposes, but his demand for money is sensitive to changes in the interest rate. The consumer receives income from his labor, from the rental on any capital or land that he owns, and from the interest payments on bonds that he has purchased. He may also receive direct transfer payments from the government. He pays sales taxes on the goods he consumes, as well as tariffs on imported goods. The consumer's bond holdings are also subject to a capital loss if the domestic interest rate falls. His maximization problem is thus:

$$\max U(x) \quad x = (x_1, L_1, x_2, L_2) \tag{3}$$

such that:

$$(1 + t_i)P_i x_i + P_{Li}x_{Li} + P_{Mi}x_{Mi} + P_{Bi}x_{Bi} + e_i P_{BFi}x_{BFi} \tag{3a}$$

$$= P_{Ki}(1 - \delta)^i K + P_{Li}L + P_{Mi}x_{M(i-1)} + r_{(i-1)}x_{B(i-1)} + P_{Bi}x_{B(i-1)} + e_i P_{BFi}x_{BF(i-1)} + TR_i$$

$$\log P_{Mi}x_{Mi} = a + b \log (1 + t_i)P_i x_i - c \log r_i \tag{3b}$$

$$\log P_{Bi}x_{Bi} - \log e_i P_{BFi}x_{BFi} = \alpha + \beta(\log r_i - \log e_i r_{Fi}) \tag{3c}$$

where:

$P_i$ = price vector of consumption goods in period i.

$x_i$ = vector of consumption in period i.

$t_i$ = vector of sales tax rates in period i.

$P_{Li}$ = price of leisure in period i.

L = initial holding of labor/leisure.

$P_{Ki}$ = price of capital in period i.

K = initial holding of capital.

$\delta$ = rate of depreciation of capital.

$x_{Li}$ = consumption of leisure in period i.

$P_{Mi}$ = price of money in period i. Money in period 1 is the numeraire and hence has a price of 1. A decline in the relative price of money from one period to the next represents inflation.

$x_{Mi}$ = holdings of money in period i.

$P_{Bi}$ = discount price of a domestic bond in period i.

$r_i$ = domestic interest rate in period i.

$x_{Bi}$ = quantity of domestic bonds purchased in period i.

$e_i$ = the exchange rate in terms of units of domestic currency per unit of foreign currency in period i.

$P_{BFi}$ = foreign currency discount price of foreign bonds in period i.

$x_{BFi}$ = quantity of foreign bonds purchased in period i.

$TR_i$ = transfer payments from the government in period i.

a, b, c, $\alpha$, ß = estimated constants.

Thus the left hand side of equation (3a) represents the value of consumption of goods and leisure, as well as of financial assets. The right hand side contains the value of the consumer's holdings of capital and labor, as well as the principal values and interest that he receives from the domestic and foreign financial assets that he held at the end of the previous period. Thus his budget constraint is affected by both interest and exchange rates. Equation (3b) is a standard money demand equation in which the demand for cash balances depends upon the domestic interest rate and the value of intended consumption. Finally, equation (3c) says that the proportion of savings made up of domestic and foreign interest bearing assets depends upon relative domestic and foreign interest

rates, deflated by the exchange rate. If no holding of foreign assets is permitted, then savings is entirely made up of domestic bonds.

The key behavioral equation we need to estimate for the domestic consumers is an interest sensitive money demand equation. The consumer, according to our formulation, has a demand for money represented by a functional form, uniform across all consumers, in which demand for nominal cash balances depends on the value of current consumption and the nominal interest rate. This demand may thus be interpreted as a cash-in-advance constraint in which the velocity of money is interest-sensitive. An increase in the nominal interest rate then lowers the demand for money, tending to raise the rate of inflation.

Accordingly, we estimated a money demand specification which is consistent with our macro model, and used various money definitions for the dependent variable. Equation (4) gives the estimated form of the equation:

$$\log M/P = a_0 + a_1 \log GDP + a_2 \log r + a_3 \log M/P_{-1} \qquad (4)$$

Here we make the following definitions:

M = Money stock (we will use various definitions)

P = Wholesale price index

GDP = Real GDP

r = interest rate

We assume an instantaneous adjustment of the money supply to the desired level, since this corresponds to our macro model. Using $M_2$, broad money, as the dependent variable, we estimated the equation over the period 1961-87 using annual data with the following results:

$$\log M/P = \underset{(-0.05)}{-0.051} + \underset{(2.71)}{0.385} \log GDP - \underset{(-1.31)}{0.080} \log r + \underset{(6.02)}{0.733} \log M/P_{-1} \qquad (5)$$

$$\bar{R}^2 = .96 \quad H = 0.94$$

The numbers in parenthesis are t-statistics. It is useful to derive the long run form of the estimated equation, when the real money stock is constant. Setting $M/P=M/P_{-1}$ we obtain:

$$\log M/P = -0.191 + 1.442 \log GDP - 0.30 \log r \qquad (6)$$

Hence the long run elasticity of real cash balances with respect to real income is 1.442, and with respect to interest rate changes it is -0.30. The greater than 1.0 elasticity with respect to real income probably reflects the steadily increasing monetization of the economy.

We also carried out a similar estimation using the rate of inflation, $\pi$, as an explanatory variable, since it may be claimed that the interest rate is not market determined in Pakistan and hence does not reflect the true opportunity cost of holding money.[10] The resulting equation estimate is:

$$\log M/P = \underset{(0.11)}{-0.109} + \underset{(1.55)}{0.195} \log GDP - \underset{(-4.08)}{1.049}\,\pi + \underset{(8.44)}{0.882} \log M/P_{-1} \qquad (7)$$

$$\bar{R}^2 = 0.97 \qquad \text{H-test} = 0.81$$

We thus notice that inflation is highly significant in this equation, although GDP no longer is.

Finally, it may be useful to report the outcomes of carrying out the money demand estimates using $M_1$, currency plus demand deposits, rather than $M_2$, as the dependent variable. The outcome using the interest rate as the explanatory variable was:

$$\log M/P = \underset{(0.10)}{0.032} + \underset{(3.15)}{0.455} \log GDP - \underset{(-1.66)}{0.098} \log r + \underset{(4.59)}{0.650} \log M/P_{-1} \qquad (8)$$

$$\bar{R}^2 = 0.95 \quad \text{H-test} = 1.02$$

We thus obtain the long run form of the estimated equation as:

$$\log M/P = 0.91 + 1.297 \log GDP - 0.280 \log r \quad (9)$$

which is broadly similar to the outcome arrived at with $M_2$ as the dependent variable.

The consumer saves by purchasing domestic bonds, in addition to holding money. He receives the interest payments on these bonds, as well as possible capital gains. As indicated in equation (3) we also allow for the possibility of consumer's holding foreign assets by formulating a portfolio balance model in which consumers divide their savings between domestic and foreign assets on the basis of relative interest rates deflated by the expected rate of change of the domestic currency relative to the foreign currency. There is an elasticity of substitution between domestic and foreign assets, so that we do not necessarily obtain factor price equalization. If it is forbidden to hold foreign currency, then we could impose the condition that the share of foreign assets in the portfolio is set to zero. Since the consumer is thus sensitive to both interest rates as well as the exchange rate, government policies that affect either of these will have an immediate impact on the consumer.

The consumer pays market prices plus sales taxes for all goods except agriculture, which may, for some consumers, be subsidized. In addition, he pays personal income taxes, while profit taxes are paid at the enterprise level. The total value of the consumer's consumption in each period must be equal to his corresponding income, so that we do not permit personal borrowing, a simplification that seems reasonable for Pakistan. In the final period of the model we impose an exogenous savings rate on the consumers.[11] Thus savings rates are endogenously determined by intertemporal maximization in period 1, but are fixed in period 2.

### 3. Financing the Central Government

The government collects income, profit, and sales taxes, as well as import duties, and pays subsidies. In addition, the government must cover both domestic and foreign interest obligations on public debt. The deficit of the central government in period 1, $D_1$, is then given by:

$$D_1 = G_1 + S_1 + r_1 B_0 + e_1 r_{F1} B_{F0} - T_1 \qquad (10)$$

where $S_1$ represents subsidies given in period 1, $G_1$is spending on goods and services, while the other two terms reflect domestic and foreign interest obligations of the government, based on its initial stocks of debt. Thus, for example, policies that cause the exchange rate to depreciate will increase foreign interest payments. $T_1$ represents total revenues of the government.

The resulting deficit is financed by a combination of monetization and domestic and foreign borrowing. Then if $y_{BG1}$ represents the face value of domestic bonds sold by the government in period 1, and $C_{F1}$ represents its foreign borrowing, then its budget deficit in period 2 is given by:

$$D_2 = G_2 + S_2 + r_2(y_{BG1} + B_0) + e_2 r_{F2}(C_{F1} + B_{F0}) - T_1 \qquad (11)$$

where $r_2(y_{BG1}+B_0)$ represents the interest obligations on outstanding debt plus domestic borrowing from period 1, and $e_2 r_{F2}(C_{F1}+B_0)$ is the interest payment on foreign debt plus period 1 foreign borrowing.

The intuition behind the determination of the interest rate should now be apparent. There are two sources of domestic bond creation, private investors financing capital formation, and the government financing budget deficits. Consumers demand bonds for savings and increases in real interest rates tend to induce them to save more. At the same time, increases in interest rates cause

consumers to reduce their money holdings, driving up the rate of inflation. Accordingly, the combination of all these factors, along with expectations of the future price of consumption, determine an equilibrium price of bonds and hence an interest rate.

4. The Foreign Sector

The foreign sector is represented by a simple export equation in which aggregate demand for exports is determined by domestic and foreign price indices, as well as world income. Hence the foreign currency value of exports is sensitive to changes in the exchange rate as well as to domestic price changes. The combination of the export equation and domestic supply responses then determines aggregate exports. Foreign lending has not been modelled, but has been taken to be exogenous. Thus gross capital inflows are exogenous, but the overall change in reserves is endogenous, depending upon savings behavior and demand for imports of consumers.[12]

Using annual data over the period 1970-87 we estimated the following export equation:

$$\log X = \underset{(-6.17)}{-14.027} \underset{(-0.23)}{- 0.095 \log XP} + \underset{(1.46)}{0.708 \log XPW} + \underset{(3.86)}{2.639 \log GDPW} \qquad (12)$$

$$\bar{R}^2 = 0.96 \quad D.W. = 1.34$$

Here we have made the following definitions.

X = US$ value of Pakistani exports

XP = Price index of Pakistani exports in terms of US$

XPW = Price index of world exports in terms of US$

GDPW = Index of world income in terms of US$

We thus see that all coefficients have the correct anticipated sign, if we interpret equation (12) as a demand equation. World income is highly significant in explaining Pakistani exports. When we included Pakistani income as an explanatory variable, it was found to not be significant and to cause the overall explanatory power of the export equation to deteriorate. Although many other functional forms could be estimated to explain exports, equation (12) is especially useful since it has the correct specification to be incorporated in our macro model. It appears that the world export price index has greater explanatory power in determining Pakistani exports than does the Pakistani export price index. This may simply reflect the fact that Pakistan is a small country.

## IV. A Benchmark Simulation for Pakistan

In order to use our model for counter-factual simulations, it is first necessary to see how well it replicates historical outcomes. Accordingly, we have incorporated the various estimated parameters described above and have then run the macroeconomic model for the years 1986-87 to 1987-88, taking 1985-86 as the base year. By this we mean that initial allocations of capital, land, urban and rural labor, money, domestic bonds, and foreign reserves are given by their stocks at the end of 1985-86.

We then take tax rates to have their estimated effective values. Government current and capital expenditures are given their actual values for 1986-7 and 1987-88. We also suppose that the Central Bank wishes to maintain a level of reserves equal to two months of the level of imports in 1985-86. Clearly this is an arbitrary rule, and in practice, Pakistani Central Bank reserves have been much lower in recent years. However the rule corresponds to a standard policy prescription. The Central Bank does not maintain a pure float to achieve this goal. Rather, referring to Diagram 1, if the level of reserves falls below its target level the slope of the Central Bank's devaluation is set equal to -2.0. If the level of reserves rises above the target level, then the Bank revalues with a slope

of -0.5. Clearly these numbers are also arbitrary, but, as we shall see, they yield exchange rate changes that closely approximate actual changes. Since the Central Bank of Pakistan was actually intervening in the exchange market during this period more actively than our model specifies, we should not expect that our overall results are an exact replication of reality. Finally, given the estimated behavioral parameters, we solve for an equilibrium for the two year period in question.

For our benchmark simulation we take investment tax credits to be 15 percent for manufacturing activities in various sectors of the economy. Table 2 reports the simulation outcomes of macroeconomic variables, with actual historical values in parenthesis. It may be worth making a few remarks concerning the simulated and actual values. First notice that our model generates rates of growth in real GDP that is fairly close to the historical values. Government revenues are higher than their actual historical levels, possibly because we have exaggerated the coverage of the tax system. At the same time, government expenditure levels are higher than the historical pattern, possibly because we attributed a higher level of debt service to the public sector than actually occurs. The overall budget deficit is, nonetheless, approximately equal to the actual deficit in both years. Export behavior is closely in line with reality, while we tend to underestimate imports, probably because our estimated import elasticities do not fully reflect the pent-up demand for imports, both for final consumption and for intermediate inputs, in Pakistan. Inflation is in line with the actual rate of change in the wholesale price index, while interest rates are somewhat higher than actual long term rates. This discrepancy may stem from the fact that there are restrictions on interest rates that are reflected in the historical data, thereby making them lower than if they were truly market determined. Finally, the simulated exchange rate generates a slight appreciation, rather than the depreciation that actually was realized. This is primarily the result of our simulated real interest rate being higher than the actual real rate.

Table 2: Base Simulation with Historical Government Fiscal Parameters (15 percent Investment Tax Credits a/

| | 1986-87 | | 1987-88 | |
|---|---|---|---|---|
| Nominal GDP b/ | 608.1 | (608.1) | 677.2 | (685.9) |
| Real GDP c/ | 89.6 | (89.6) | 92.8 | (94.4) |
| Government spending h/d/ | 190.2 | (152.4) | 231.2 | (179.9) |
| Revenues g/ | 144.7 | (103.9) | 170.2 | (118.6) |
| Government budget deficit g/ | -45.5 | (-48.5) | -61.0 | (-61.3) |
| Private investment g/e/ | 45.6 | (38.2) | 46.2 | (42.8) |
| Exports g/ | 83.2 | (81.2) | 93.4 | (97.5) |
| Imports g/ | 99.5 | (120.5) | 116.7 | (138.3) |
| Trade balance g/ | -16.3 | (-39.3) | -23.3 | (-40.8) |
| Inflation rate f/ | 5.0 | (5.0) | 7.5 | (10.2) |
| Interest rate d/ | 15.3 | (15.3) | 24.9 | (13.5) |
| Exchange rate f/ | 17.4 | (17.4) | 16.3 | (18.0) |

| | Net Real Capital Formation: 1986-88 | Real Output | | Tax Revenue h/ Paid | |
|---|---|---|---|---|---|
| | | (1) | (2) | (1) | (2) |
| Other manufacturing | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Textiles | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Mining | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Food production | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Services and government | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| | Urban Consumer | Rural Consumer i/ |
|---|---|---|
| Welfare index | 100.0 | 100.0 |

a/ The numbers in parenthesis are actual historical values.
b/ In billions of Rupees at market prices. The model has been normalized so that simulated nominal and real GDP are equal to historical values in 1986-87.
c/ In billions of constant 1959-60 Rupees.
d/ Interest rate on long term (five year and over) bank deposits.
e/ There is a problem in our simulations of distinguishing between private investment and government capital expenditures. Accordingly, we tend to underestimate government capital expenditures and overestimate private investment. The sum of the two is approximately correct, however.
f/ Inflation rates are normalized so as to have their historical values in the initial year. We are using the rate of inflation in the wholesale price index.
g/ In billions of Rupees.
h/ All three of these columns are index numbers which we will use to make comparisons when we calculate the effects of introducing investment and employment tax credits. The numbers (1) and (2) refer to 1986-87 and 1987-88, respectively.
i/ We calculate utility levels in each simulation and use the levels of this simulation as a benchmark.

## V. Tax Policy Simulations

It therefore seems reasonable to use our model to carry out counter-factual simulations. Our first exercise will be to examine the implications of raising the investment tax credit rate from 15 to 30 percent. Although this doubling is arbitrary, it should give some notion of the effectiveness of increasing tax credits. The resulting outcomes are given in Table 3.

We thus observe that aggregate real investment has risen by 11.7 percent in 1986-87 and by 25.7 percent in 1987-88 at the same time the real interest rate has declined from 9.8 per cent to 0.6 percent in 1986-87, while in 1987-88 it rose from 16.2 percent to 23.7 percent. Accordingly, if we compound the real interest rates over the two years of the simulation, we see that there has been an aggregate decline of 2.5 percent in the real interest rate. Thus, the overall decline in real interest rates, combined with the doubling of the investment tax credit, has brought about the large increase in real investment.

We thus notice that the use of increased investment tax credits caused a loss of approximately 1.3 percent of real GDP in the second year, as compared with the simulation reported in Table 2. This decline has taken place despite the fact that, in Table 3, private investment has risen and, in addition, the fact that real government spending fell by 0.6 percent in 1986-87 and rose by 4.9 percent in 1987-88, leading to an aggregte real increase of 4.3 percent, as compared to Table 2. Much of this increase comes, however, from the cost of the investment subsidy. Sectoral real production has, at the same time, uniformly declined in both periods, as compared with Table 2, as factors have been shifted out of current production into investment. As might then be expected, there have been corresponding losses in aggregate welfare for both consumers.[13]

The government budget deficit has remained at 7.5 percent of GDP in both simulations in 1986-87, while in 1987-88 it has risen from 9.0 to 10.5 percent of GDP in Table 3. Thus the increase in the investment tax credit does eventually cause an increase in real budget deficit, although this

Table 3: Simulation with Investment Tax Credits
Set at 30 percent a/

| | 1986-87 | 1987-88 |
|---|---|---|
| Nominal GDP b/ | 686.4 | 763.7 |
| Real GDP c/ | 89.1 | 91.6 |
| Government spending h/d/ | 214.6 | 277.3 |
| Revenues g/ | 163.3 | 197.4 |
| Government budget deficit g/ | -51.3 | -79.9 |
| Private investment g/e/ | 57.8 | 76.7 |
| Exports g/ | 90.6 | 101.7 |
| Imports g/ | 109.8 | 132.5 |
| Trade balance g/ | -19.2 | -30.8 |
| Inflation rate f/ | 19.2 | 8.2 |
| Interest rate d/ | 19.9 | 33.8 |
| Exchange rate f/ | 19.0 | 20.0 |

| | Net Real Capital Formation: 1986-88 | Real Output | | Tax Revenue h/ Paid | |
|---|---|---|---|---|---|
| | | (1) | (2) | (1) | (2) |
| Other manufacturing | 133.3 | 97.1 | 95.4 | 97.2 | 97.0 |
| Textiles | 127.3 | 97.0 | 95.4 | 100.9 | 103.4 |
| Mining | 116.9 | 96.6 | 94.8 | 101.4 | 96.9 |
| Food production | 101.0 | 97.6 | 95.9 | 84.3 | 83.1 |
| Services and government | 122.5 | 96.9 | 95.1 | 101.6 | 104.5 |

| | Urban Consumer | Rural Consumer i/ |
|---|---|---|
| Welfare index | 98.7 | 84.7 |

a/ The numbers in parenthesis are actual historical values.
b/ In billions of Rupees at market prices. The model has been normalized so that simulated nominal and real GDP are equal to historical values in 1986-87.
c/ In billions of constant 1959-60 Rupees.
d/ Interest rate on long term (five year and over) bank deposits.
e/ There is a problem in our simulations of distinguishing between private investment and government capital expenditures. Accordingly, we tend to underestimate government capital expenditures and overestimate private investment. The sum of the two is approximately correct, however.
f/ Inflation rates are normalized so as to have their historical values in the initial year. We are using the rate of inflation in the wholesale price index.
g/ In billions of Rupees.
h/ These are index numbers which we will use to make comparisons when we calculate the effects of introducing investment and employment tax credits. The numbers (1) and (2) refer to 1986-87 and 1987-88, respectively.
i/ We calculate utility levels in each simulation and use the levels of this simulation as a benchmark.

increase does not necessarily seem to be unsustainably high. It is interesting to note that total real tax revenues are slightly lower in period 1 and higher in period 2 in this case than in the previous case, although tax changes are uneven across sectors. This is due to the fact that the investment tax credits have brought about increases in capital stocks, thereby increasing primary tax revenues in the second period, when the new capital is on line. In the first period, however, capital has been transferred from current to capital production, in response to the increased investment tax credits, thereby reducing revenues. The inflation and interest rates have increased, and the balance of payments has deteriorated in both periods, as compared to Table 2. Thus, although the goal of increasing the rate of capital formation has been achieved, the macroeconomic consequences of the investment tax credit increase do not seem favorable.

Let us now suppose that the government attempts to avoid the adverse consequence of the investment tax credit increase yet still achieve some increase in the rate of capital formation. Accordingly, it uses an alternative approach in which there is a reduction in the rate of capital taxation. As an example, we will suppose that the statuatory corporate tax rate is reduced from 55 percent to 30 percent in the second year of the simulation. The resulting simulation results are given in Table 4.

We thus observe that the use of the reduced corporate profit tax in period 2 has caused there to be a welfare improvement over both the base simulation, as well as the simulation with increased investment tax credits. There has been a somewhat reduced rate of capital formation, as compared with the case of increased investment tax credits, although investment is still higher than in the base case. The one apparent drawback with the reduced capital tax rate is that it has brought about a sharply increased budget deficit in the second period, primarily because the tax reduction applies to all segments of the economy.

Table 4: Simulation with Corporate Tax Rate Reduced to 30 percent in Second Period a/

| | 1986-87 | 1987-88 |
|---|---|---|
| Nominal GDP b/ | 635.1 | 736.3 |
| Real GDP c/ | 89.1 | 103.4 |
| Government spending h/d/ | 194.7 | 244.2 |
| Revenues g/ | 152.1 | 127.3 |
| Government budget deficit g/ | -42.6 | -116.9 |
| Private investment g/e/ | 47.6 | 47.2 |
| Exports g/ | 86.7 | 99.0 |
| Imports g/ | 104.3 | 127.7 |
| Trade balance g/ | -17.3 | -28.7 |
| Inflation rate f/ | 10.3 | -0.1 |
| Interest rate d/ | 19.5 | 34.9 |
| Exchange rate f/ | 18.1 | 20.9 |

| | Net Real Capital Formation: 1986-88 | Real Output | | Tax Revenue h/ Paid | |
|---|---|---|---|---|---|
| | | (1) | (2) | (1) | (2) |
| Other manufacturing | 138.8 | 99.7 | 102.6 | 101.0 | 64.4 |
| Textiles | 108.0 | 99.7 | 101.8 | 100.4 | 61.3 |
| Mining | 96.4 | 99.8 | 104.4 | 99.1 | 59.5 |
| Food production | 134.9 | 99.7 | 102.5 | 106.7 | 68.1 |
| Services and government | 106.8 | 99.8 | 103.7 | 100.5 | 62.5 |

| | Urban Consumer | Rural Consumer i/ |
|---|---|---|
| Welfare index | 101.5 | 103.3 |

a/ The numbers in parenthesis are actual historical values.
b/ In billions of Rupees at market prices. The model has been normalized so that simulated nominal and real GDP are equal to historical values in 1986-87.
c/ In billions of constant 1959-60 Rupees.
d/ Interest rate on long term (five year and over) bank deposits.
e/ There is a problem in our simulations of distinguishing between private investment and government capital expenditures. Accordingly, we tend to underestimate government capital expenditures and overestimate private investment. The sum of the two is approximately correct, however.
f/ Inflation rates are normalized so as to have their historical values in the initial year. We are using the rate of inflation in the wholesale price index.
g/ In billions of Rupees.
h/ These are index numbers which we will use to make comparisons when we calculate the effects of introducing investment and employment tax credits. The numbers (1) and (2) refer to 1986-87 and 1987-88, respectively.
i/ We calculate utility levels in each simulation and use the levels of this simulation as a benchmark.

We may thus conclude that, at least in the case of Pakistan, a reduction in the capital income tax rate is superior to an increase in investment tax credits as an instrument for improving investment performance.

## VI. Conclusion and Policy Implications

We have constructed a simple model designed to address the issue of investment tax credits in Pakistan. The general structure of our model is a two period general equilibrium system. All agents have perfect foresight, and hence in period 1 correctly anticipate the prices of period 2. A solution is found for both periods simultaneously, so that we determine outcomes for those two years, and hence corresponding rates of change. We first show that our model specification and estimation yields reasonably accurate replication of Pakistani reality. We then use the estimated model to address two alternative scenarios.

In the first of these scenarios we attempt to estimate the effect of increasing the investment tax credit rate from 15 percent to 30 percent. We observe that the new fiscal regime causes, among other things, a welfare deterioration, while leading to a significant increase in inflation rates. In the second simulation, we retain the original investment tax credit rates but reduce the statuatory corporate tax rates. The new results are welfare improving as compared to both the original scenario as well as the example with increased investment tax credits.

We thus conclude that, at least in the case of Pakistan, that changes in the corporate tax rates seem be superior to increased investment tax credits as instruments for promoting capital formation. In particular, cuts in corporate taxes produce outcomes that are welfare superior to those that occur with an investment tax increase. The increases in capital formation that are stimulated by the increased investment tax credits are greater than those brought about by decreased corporate taxes, but the tax credits also have significant negative macroeconomic consequences.

## ENDNOTES

1. The dissaggregated sectors are those given in Ahmad, Barrett and Coady (1985), in which an 87 sector matrix is derived to represent Pakistan's technology for 1981. The aggregation is carried out by simply adding corresponding rows and columns.

2. This treatment is commonly known as the Armington assumption in the literature. In order to derive input-output coefficients for imports as intermediate inputs to production we have used sectoral flows given in Ahmad et al. (1985), Table 27b, column 3, and have aggregated according to the sectoral pattern given in Table 1.

3. This may be interpreted as an accelerated depreciation allowance, since the firm is permitted to take the allowance in the current period, although the capital does not come on line until the next period.

4. This formulation of the investment tax credit is adapted form Auerbach and Hines (1988).

5. Errors associated with these proxies are not known.

6. See "Relationship Between Economic Growth and Investment in Pakistan; A Study in Incremental Capital Output Ratio," by Nadeem A. Burney, unpublished paper, Pakistan Institute of Development Economics, (August, 1988). The numbers we use are taken from Table 10, (Aggregate Private Investment Function with Instantaneous Adjustment).

7. Current spending may, via its impact on wages, the availability of capital, and the interest rate indirectly have very considerable impact upon private output.

8. The assumption of equal relative spending on different goods by both urban and rural consumers is probably inaccurate. There is, however, insufficient data, for us to estimate individual demand functions.

9. The flaw in this approach is that it does not separate final demand into private demand, government demand, and exports. We lack sufficient data to construct such a breakdown, however, at the level of disaggregation we wish, so we have had to use total final demand as a proxy for private demand.

10. We tried several variations of this formulation. In one we used an adaptive expectations scheme to derive an expected rate of inflation. Using the current rate of inflation is of course equivalent assuming instantaneous adjustment of expectations. We also used a perfect foresight formulation in which the expected rate of inflation is equal to next period's actual rate of inflation. The use of actual inflation rates turned out to be superior to any of the other methodologies.

11. The exogenous savings rate is imposed in order that consumers have a demand for bonds in the final period. Otherwise all outstanding debt would have to be paid off and, in particular, the entire stock of public debt would have to be liquidated.

12. Import demand is derived from the consumer optimization problem and hence depends upon relative foreign and domestic prices as well as disposable income. Hence consumer demand for imports implicitly reflects an estimated import price elasticity as well as an income elasticity.

13. The full employment model used here incorporates a labor supply function. Thus labor may not be fully employed although capital is always fully employed. The treatment of involuntary unemployment remains problematic in these models.

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