SDF-45

DOMESTIC FINANCE NO. 45

A STATISTICAL ANALYSIS OF THE DYNAMICS OF ECONOMIC GROWTH IN IRAN: 1959-73

By

William A. Dellalfar
and
Javad Khalilzadeh-Shirazi

This paper was prepared for presentation at the Eleventh Annual Meeting of the Middle East Studies Association of North America, November 10-12, 1977, New York. The authors wish to thank Messrs. V.V. Bhatt and N. Carter for their encouragement and support, without, however, in any way implicating them or their respective divisions, Public and Private Finance, and Comparative Analysis and Projections. The views presented in this paper are solely those of the authors and do not necessarily reflect the official opinions or views of the World Bank or its affiliates.

Public and Private Finance Division
Development Economics Department
Development Policy Staff

December 1977

C O N T E N T S

I

INTRODUCTION

During the period from 1959 to 1973,[1/] the Iranian economy grew fairly rapidly. This paper will examine three significant features of the growth of the economy during this period. First, the nonagricultural sectors expanded rapidly with a significant increase in the role and the participation of the government in these sectors. Funded by increasing oil revenues, the government's share in real consumption and investment expenditures rose dramatically. Second, real output in the agricultural sector grew sluggishly. The slow growth of output and the increase in the demand for this sector's output induced a rise in agricultural imports and relative prices. The increase in the demand for agricultural products was a result of the growth in private real consumption expenditures. Finally, following a decade of price stability, the rate of inflation increased after 1970. After 1970, the money supply began to increase rapidly as the government spent its growing revenue from oil exports. This rise in the money supply was the primary impetus to inflation, since the demand for real cash balances did not increase as rapidly.

II

THE BEHAVIOR OF AGGREGATE REAL EXPENDITURES [2]

A. Aggregate Real GDP

From 1959 to 1972, real GDP at factor cost in Iran grew at an annual compound rate of 9.6 percent.[3] Growth was, however, generally accelerating during this period from just over 6 percent per annum at the beginning of the period to over 12 percent a year at the end of the period. These high aggregate growth rates translated into a real GDP per capita compound growth rate of 6.5 percent a year between 1959 and 1972. The per capita real GDP growth rate accelerated from approximately 3 percent in 1959 to over 8.0 percent by the end of 1972. (The growth rate of per capita real GDP are 8.6 percent in 1971, 11.6 percent in 1972 and 9.7 percent in 1973.) The annual compound growth of population during this period was 2.9 percent. By 1973, the growth of population was beginning to decline. Population grew at 2.8 percent at the beginning of the period, increased to 3 percent a year and then the growth rate began to decline.

B. Real Consumption Expenditures

Between 1959 and 1972 real consumption expenditures, the sum of both private and public, grew at an annual compound rate of 8.6 percent. The annual compound growth rate between 1959 and 1973 was somewhat higher at 9.0 percent since total real consumption expenditures grew by 14.2 percent between 1972 and 1973. Since real consumption expenditures were growing slightly slower than real GNP during this period, the share of real consumption expenditures in total real expenditures declined somewhat over time. Indeed, real consumption expenditures declined from 84.4 percent of real GNP in 1959 to 78.9 percent in 1972 and 67.4 percent in 1973.

The decline in the share of real consumption expenditures in total real expenditures conceals a shift from private to public consumption expenditures. The share of public real consumption in total consumption grew from 12.7 percent in 1959 to 29.7 percent in 1972 and 30.6 percent in 1973. While the growth of private real consumption expenditures was accelerating from annual compound rates of under 4 percent to over 7 percent, the growth rate of public real consumption expenditures increased from under 2 percent to over 16 percent a year. The phenomenal growth in public expenditures was, of course, funded by increasing government revenues from the export of petroleum. The very rapid increase in government expenditures during this period is illustrated by the fall in the share of nominal public current expenditures in total government expenditures from 75.4 percent in 1959 to 70.3 percent in 1972 and 68.8 percent in 1973.

From 1959 to 1972, private real consumption expenditures increased at an annual compound rate of 6.8 percent. Since population grew by

about 2.8 percent a year, per capita private real consumption grew by approximately 4 percent annually. The growth of real private expenditures was not purely exponential. The annual compound growth rate conceals annual changes in real private consumption expenditures ranging from 1.0 percent to over 12 percent. To determine the factors behind the growth and fluctuations in private real consumption, we analyzed the data using simple regression techniques. (The appendix discusses the basic econometric problems encountered in this paper.)

Private real per capita consumption expenditures are assumed to be a function of per capita disposable income, the interest rate, the expected rate of inflation, and a measure of liquid assets. Private per capita disposable income is approximated by GNP minus total government revenue. The price deflator used is the consumption (private) GDP deflator.[5/,6/] In the regression, per capita disposable income is entered as a current variable and also lagged once. The interest rate is represented by the Central Bank discount rate. While an increase in the discount rate will discourage consumption by increasing the attractiveness of savings and assets, it could encourage current consumption by making it easier to reach a target level of savings. (The rise in the interest rate could also increase consumption expenditures if the consumption expenditure series includes expenditures on items used as assets by consumers.) An increase in the expected rate of inflation will lead to an increase in real consumption expenditures if consumers attempt to build stocks of goods whose price is expected to increase faster than other assets. On the other hand, a higher rate of

inflation will also lead to a fall in the real value of financial assets. An attempt to maintain the real value of asset holdings will induce a fall in real consumption expenditures when the expected rate of inflation rises. (The expected rate of inflation is approximated by the actual increase in the consumption deflator lagged one year.) Liquid assets, represented by M1 or M2, are expected to have a positive effect on real private consimption expenditures. An increase in real liquid asset holdings, other things being equal, should lead to an increase in consumption expenditures. Finally, the equation contains a dummy variable equal to 1 in 1973 and 0 in other years.[7/] By 1973, petroleum prices had begun to increase rapidly and the economy was beginning to undergo structural changes.

Table I gives the results for the per capita private real consumption regressions. In regressions I.1 to I.4 we see that the inclusion of liquid assets (M1, M2, or either of them lagged) yields either a negative coefficient for liquid assets which is not expected ex ante and which is not 'significantly' different from zero, or it yields a long run MPC which is ridiculously small.

In regression I.5 we drop the liquid asset term. One important and notable feature of this regression is the Durbin-Watson statistic which is fairly close to 2.0. The estimated long-run MPC in this regression is .68 with a 95 percent confidence interval of (.51, .85). While income does appear to have lagged effect on consumption, the main determinant of current consumption is current income. (Not only is the coefficient of current income approximately twice as large as the coefficient of lagged income, its standard error is much larger. The latter is probably due to

TABLE I

Real Per Capita Private Consumption

		$\frac{(IGNP-IGOVREV)}{IPOP.\frac{IPCONP}{100}}$	$\frac{(IGNP-IGOVREV)}{IPOP.\frac{IPOCNP}{100}}$	IMON/IPGNP	IINT	$\Delta \ln IPCONP_{-1}$	DUMMY /=1 in 1352/	Constant	DW	ρ	$\bar{R}^2$	See/$\overline{LHS}$	Period
I.1	IPCONR/IPOP using ITMON instead of IMON	0.74 (0.34) [2.17]	0.26 (0.26) [1.02]	-0.013 (0.013) [-0.96]	0.047 (0.103) [0.46]	-8.52 (4.99) [-1.71]	-3.06 (1.39) [-2.20]	-.670 (2.92) [-.23]	2.22	-	.990		1961-1973
I.2	IPCONR/IPOP (GLS) using ITMON instead of IMON	0.73 (0.33) [2.24]	0.30 (0.28) [1.09]	-0.014 (0.013) [-1.06]	0.032 (0.101) [0.31]	-8.79 (4.91) [-1.79]	-3.00 (1.35) [-2.22]	-0.853 (2.805) [-0.30]	2.07	-.16	.992		1962-1973
I.3	IPCONR/IPOP note that LMPC is too small using /ITMON/IPGNP/$_{-1}$	0.28 (0.28) [1.00]	-0.08 (0.42) [-0.18]	0.022 (0.023) [0.95]	0.160 (0.114) [1.40]	-13.20 (5.99) [-2.21]	-1.70 (1.08) [-1.57]	6.07 (4.17) [1.45]	1.98	-	.987		1962-1973
I.4	IPCONR/IPOP	0.81 (0.46) [1.75]	0.09 (0.32) [0.27]	-0.03 (0.03) [-0.90]	0.06 (0.12) [0.50]	-10.91 (5.29) [-2.06]	-3.18 (1.71) [-1.86]	1.08 (1.31) [0.83]	2.19	-	.994		1962/1973
I.5	IPCONR/IPOP	0.47 (0.20) [2.40]	0.21 (0.25) [0.83]	-	0.10 (0.09) [1.17]	-11.22 (4.11) [-2.73]	-2.06 (0.92) [-2.24]	2.09 (0.56) [3.74]	2.07	-	.990		1961-1973
I.6	IPCONR/IPOP	0.39 (0.19) [2.09]	0.35 (0.23) [1.54]	-	-	11.81 (4.16) [-2.83]	-1.72 (0.89) [-1.93]	1.90 (0.55) [3.48]	2.26	-	.989	2.0%	1961-1973
I.7	IPCONR/IPOP (GLS)	0.37 (0.19) [1.92]	0.38 (0.23) [1.69]	-	-	-12.54 (3.96) [-3.14]	-1.61 (0.94) [-1.71]	1.83 (0.49) [3.70]	2.13	-.18	.992	2.0%	1961-1973

SYMBOLS:
- ( ) denotes standard error
- [ ] denotes 't-statistic'
- IPCONR: private real consumption in billions of 1959 rials
- IPOP: population in millions
- IGNP: nominal GNP in billions of rials
- IGOVREV: government revenue in billions of rials
- IPCONP: total consomption GDP deflaror, 1959=100
- IMON: M1 in billions of rials
- IPGNP: GNP deflaror, 1959=100
- IINT: discount rate in percent
- DUMMY: dummy variable equal to 1 in 1973, zero otherwise
- DW: Durbin-Watson
- S.e.e: standard error of estimate
- $\overline{LHS}$: mean of the LHS variable
- GLS: generalized least squares
- ρ: parameter of first order autoregressive scheme

the collinear nature of the series.)

Regression I.5 also indicates that higher expected inflation leads to lower consumption expenditures while higher interest rates lead to higher consumption expenditures. As indicated earlier, these results suggest that consumers attempt to maintain the real value of their assets while having a target level of savings (asset holdings). While the expected rate of inflation coefficient has a small standard error and is 'significant' at the 5 percent level, the interest rate coefficient has a much larger relative standard error. At the means, the elasticity of per capita real consumption with respect to the interest rate and the expected rate of inflation is .05 and -.02. These effects are both fairly small. Although the expected rate of inflation does have a statistically significant effect on consumption expenditures, this effect is not a very important factor in the determination of consumption expenditures. (Dropping the interest rate variable whose standard error is large does not change the expected rate of inflation coefficient but it does raise the long-run MPC. This is to be expected since the interest rate and real income are both rising secularly. When one variable is excluded the remaining variable will pick up its effect. Dropping the interest rate from the equation also increases the serial correlation of the error term which suggests that perhaps it ought to be included in the regression. These results are presented in regressions I.12 and I.13.)

Finally, regression I.5 shows that the dummy variable is significant[8/] and negative. This suggests that the increase in government revenue and

expenditures induced by the increase in petroleum prices depressed private consumption expenditures. This could be due to two effects: first, government subsidies which lower real private expenditures, and second, government provision of certain goods and services.[9/]

The main results that emerge from Regression I.5 are that disposable income is the critical determinant of private real consumption behavior. The long-run MPC is .68 which suggests that private savings are an important source of the investable surplus in the economy at the margin. Private real consumption is also affected by the desire to maintain the real value of asset holdings and the desire to reach certain savings levels.

C. Real Investment Expenditures

From 1959 to 1972 total real investment grew at an annual compound rate of 11.6 percent. Between 1972 and 1973, it grew by 8.8 percent. This rate of growth was faster than the rate of growth of real GNP during this period and the share of real investment in total real expenditures rose over the period from just over 18.5 percent to over 20 percent. Table II gives the shares of real investment in real GNP and the share of government investment in total real investment.

Table II shows another interesting pattern in the behavior of real investment. The share of government investment in total real investment increased quite rapidly. By the end of the period, in 1972, government investment accounted for 56.7 percent of total real investment in Iran. The major change in the pattern of government investment occured between 1964 and 1965 (1343 to 1344) when government investment grew by 70 percent in real terms. This growth increased the share of government investment in total investment from 37.7 to 47.9 percent. From 1959 to 1973, government real investment grew at a compound annual rate of 14.2 percent.

Private investment was not stagnant during this period. Private real investment grew at an annual compound rate of 8.8 percent between 1959 and 1972.[10/] This is slightly less than the growth of GNP. As Table II indicates, the share of private investment in real expenditures declined slightly over this period. Since private real consumption expenditures also grew slower than GNP during the period from 1959 to 1972, it is clear that government expenditures were becoming increasingly important as a component of aggregate demand.

TABLE II

Investment Behavior

	Share of real investment in real GDP (percent)	Share of government real investment in total real investment (percent)	Share of private investment in GDP (percent)
1959	18.6	39.4	11.2
1960	18.6	33.2	12.4
1961	17.8	37.8	11.1
1962	15.4	36.9	9.6
1963	16.1	40.7	9.5
1964	16.8	37.7	10.7
1965	20.2	47.9	10.6
1966	19.1	44.0	10.7
1967	22.0	48.7	11.3
1968	22.2	55.7	9.8
1969	21.2	60.2	8.4
1970	20.3	59.5	8.2
1971	23.0	56.6	10.0
1972	24.8	56.7	10.8
1973	20.2	55.9	8.9

What were the determinants of private investment during this period? Private real investment is a fairly difficult variable to capture. Even in the United States with its plethora of detailed statistical data, there is still a discussion about the determinants of private real investment. The private real investment function that we have estimated for the period 1959 to 1973 (1388 to 1352) is a very simple, naive formulation. We have attempted to relate private real investment to level of real GDP lagged, the interest rate, the expected rate of inflation, and public real investment. (Expectation formation is assumed to be static and expected prices are equal to last period's change in prices.) Most theories of investment behavior connect the investment decision with the desired optimal capital stock. Actual investment is then a lag function of the desired capital stock minus the actual stock. This suggests that investment should be a distributed lag function of the determinants of the desired capital stock and the actual capital stock with the latter corrected for depreciation. The desired capital stock is taken to be a function of the desired level of output and some measure of the cost of capital. In this particular case, we do not have any information on capital stock figures. We have regressed private real investment in gross terms on GDP lagged one year and lagged two years, the interest rate, and the expected rate of change of prices. Increases in GDP are assumed to increase the desired capital stock and increase private real investment.[11/, 12/] An increase in the interest rate increases the cost of capital and reduces the desired capital stock. An increase in the expected rate of inflation will lead to a fall in the desired capital stock and a decline in real private investment if the expectation is that inflationary times will be followed by a recession which will reduce the profitability of firms. We have also included

real government investment expenditures in the regression to capture some of the economic externalities provided by government investment in infrastructure. Government investment in infrastructure and allied areas might serve as a stimulus to private investment since it might increase the rate of return on these investments by internalizing some external economies. The regression results for the private investment equation are presented in Table III. 13/

Regressions III.1 and III.2 show that the coefficient of public investment has the wrong sign. (In Regression III.2, we have corrected for first order serial correlation.) The other coefficients have the expected signs. In regressions III.3 and III.4 we have dropped public investment as an explanatory variable since the coefficient had the wrong sign and a very large standard error. Regression III.4 shows that the standard error of the expected rate of inflation is very large. Dropping this variable, we obtain regressions III.5 and III.6 with the latter corrected for first order serial correlation.

Regression III.6 shows that it is fairly difficult to separate the effects of various lags in income. The long-run effect of an increase in national income by one unit is an increase in private gross real investment of .143 units with a 95 percent confidence interval of (.07, .22).14/ This effect of output on capital and investment is fairly weak. This can be partly explained by the fact that much of the investment in heavy industry that occured during this period was undertaken by the government and not by the private sector. Private investment was concentrated on consumer goods, durable and nondurable, and in the agricultural sector. We should keep in mind, however, that the measure of income and output used here includes output produced

TABLE III

Investment Function

			Constant	IGDPR(-1)	IGDPR(-2)	IIPUBR(-1)	IINT	$\Delta \ln$(IITOTP)$_{-1}$	R^{-2}	See/ LHS	DW	ρ	Period	$\sum_{i}$ IGDPR$_{-i}$
III.1	IIPVTR		2.40 (41.14) [0.06]	0.025 (0.267) [0.09]	0.135 (0.302) [0.45]	-0.029 (0.831) [-0.04]	-3.51 (3.50) [-1.00]	-9.61 (53.44) [-0.18]	.92	12.4%	.99	-	1961-73	0.16 (0.14) [1.14]
III.2	IIPVTR	(GLS)	-11.88 (34.46) [-0.34]	0.138 (0.226) [0.61]	0.049 (0.233) [0.21]	-0.283 (0.606) [-0.47]	-1.74 (3.54) [-0.49]	-12.58 (39.35) [-0.32]	.80	10.9%	1.19	.64	1961-73	.19 (.096) [1.98]
III.3	IIPVTR		3.80 (9.19) [0.41]	0.022 (0.239) [0.09]	0.132 (0.277) [0.48]	-	-3.60 (1.95) [-1.85]	-9.72 (49.92) [-0.19]	.92	11.6%	1.00	-	1961-73	.154 (.041) [3.71]
III.4	IIPVTR	(GLS)	3.17 (10.96) [0.29]	0.083 (0.196) [0.423]	0.063 (0.225) [0.28]	-	-3.09 (1.97) [-1.57]	-11.19 (38.30) [0.29]	.84	10.3%	1.26	.57	1961-73	.146 (.035) [4.11]
III.5	IIPVTR		4.35 (8.27) [0.53]	0.024 (0.026) [0.105]	0.130 (0.262) [0.50]	-	-3.67 (1.81) [-2.03]	-	.93	11%	1.02	-	1961-73	.154 (.039) [3.94]
III.6	IIPVTR	(GLS)	3.99 (9.95) [0.40]	0.096 (0.180) [.53]	0.047 (0.207) [.53]	-	-3.18 (1.85) [-1.72]	-	.86	9.8%	1.29	.56	1961-73	.143 (.033) [4.33]

SYMBOLS:
( ) denote standard error
[ ] denote t-statistic
DW: Durbin-Watson
ρ: parameter of first order autoregressive scheme
LHS: mean LHS variable
S.e.e. standard error of estimate
IIPVTR: private real investment, billions of 1959 rials
IGDPR: real GDP in billions of 1959 rials
IIPUBR: government real investment in billions of 1959 rials
IITN : discount rate in percent
IITOTP: total investment deflator, 1959 = 100

in the public sector. Government ownership of the oil sector makes the public sector an important source of income. Increased output in this sector does not require any additional private investment.

Regression III.6 is also interesting in that it indicates that the interest rate has an effect on private real investment. An increase of one point in the discount rate leads to a fall in real private investment of 3.2 billion rials. This coefficient has a 95 percent confidence interval of approximately (-7.4, 1.01). Clearly, this is a very wide range and the coefficient is not significantly different from zero. At the means, this coefficient implies an interest rate elasticity of private real investment of -.35. It is interesting to note, nevertheless, that private real investment does appear to react somewhat to changes in the interest rate.

Finally, we can take a brief look at the composition of investment. Table IV gives the share in total real investment of construction investment. The other component of investment is investment in machinery and equipment. A breakdown of private and public investment into components is unfortunately not available. The large share of construction investment in total investment is rather remarkable. The importance of construction investment as a component of total investment peaked in the middle sixties. Even at the end of the period, however, the share of construction is close to 60 percent.

TABLE IV

The Distribution of Real Investment Expenditures Between Construction and Machinery and Equipment

Share of Construction Investment in Total Real Investment

(percent)

1959	59.6	1964	70.6	1969	66.9
1960	60.7	1965	71.9	1970	67.1
1961	67.3	1966	66.9	1971	63.2
1962	70.7	1967	63.5	1972	61.4
1963	76.9	1968	64.4	1973	59.6

III

SECTORAL OUTPUT

A. The Agricultural Sector

The agricultural sector was the laggard in domestic growth from 1959 to 1973. Excluding the dynamic oil sector, nonoil real GDP increased at an annual compound rate of 8.3 percent from 1959 to 1972. During this period, agricultural real value added increased at an annual compound growth rate of 3.6 percent. This low growth rate reflects the very slow growth of the agricultural sector between 1959 and 1963 when the annual growth rates were between 1.0 and 2.0 percent. After 1963, growth in this sector picked up. For example, the annual compound growth rate between 1963 and 1973 was 4.5 percent. This figure understates growth since it includes one year, 1971, in which output declined by 3.7 percent. As Table V shows, the share of agricultural value added in nonoil GDP and in total GDP declined steadily during this period. In 1959, 36 percent of nonoil GDP originated in the agricultural sector. The contribution of agriculture was only 18.7 percent in 1973.

The rapid growth of income in the Iranian economy increased the demand for agricultural products. Agricultural imports were another source of supply. Table VI shows that until 1971, agricultural imports were not a significant source of supply. Indeed, until 1971, not only were net imports of agricultural products quite small, but, there were quite a few years with net exports of agricultural products. After 1970, agricultural imports began to increase quite rapidly. There are both 'supply' and 'demand' elements to this growth of agricultural imports after 1970. On the supply side, foreign

TABLE V

Share of Agricultural Value Added in GDP

	Share of Agricultural Real Value Added in Non-Oil Real GDP (percent)	Share of Agricultural Real Value Added in Real GDP (percent)
1959	35.8	29.9
1960	34.9	28.8
1961	34.3	28.0
1962	33.2	26.5
1963	32.0	25.4
1964	30.3	23.8
1965	29.3	22.9
1966	28.2	21.7
1967	27.6	21.0
1968	26.1	20.1
1969	24.3	18.9
1970	22.8	17.7
1971	19.9	15.1
1972	20.0	14.4
1973	18.7	13.6

TABLE VI

Ratio of Agricultural Net Imports to Agricultural Value Added

1959	0.018
1960	0.033
1961	0.010
1962	0.001
1963	0.010
1964	0.042
1965	0.003
1966	0.003
1967	-0.020
1968	-0.009
1969	-0.035
1970	-0.029
1971	0.097
1972	0.150
1973	0.386

Both Net Imports and Value Added are in nominal terms. Negative signs indicate net exports.

exchange availability increased after 1970 as oil prices began to rise. The government might have relaxed import restrictions at this point. On the demand side, the additional oil revenue was a stimulus to growth and thus increased income and the demand for agricultural goods. The role of imports can be better understood by looking at the relative price of agricultural goods. Imports can be seen as a policy instrument to be used by the government to control the relative price of agricultural goods by augmenting domestic availability of supply.

We fit an equation to explain the behavior of the relative price of agricultural goods. The relative price of agricultural goods is measured with respect to the prices of industrial goods. (The ratio of the GDP deflator for agricultural value added to industrial value added is denoted the agricultural terms of trade.) The agricultural terms of trade increased from 1959 to 1965, declined from 1965 to 1969, increased from 1969 to 1971, and began to decline again after 1971. Recall that agricultural value added was growing quite slowly in real terms until 1963. This contributed to the rise in the agricultural terms of trade. While increased growth stemmed the rise in agricultural relative prices for a short period of time, prices began to increase again as the economy grew more rapidly than the agricultural sector. The large increases in agricultural imports after 1971 contributed to the decline in agricultural relative prices.

To derive the equation, for the agricultural terms of trade start with the market clearing condition that supply equals demand at some relative price.[15/] Expand the functions on both sides of the equation by a Taylor series and normalize on the agricultural terms of trade. This will make the agricultural terms of trade a function of all determinants of the

supply of and the demand for agricultural products. On the supply side, the relevant factors are output (value added in the agricultural sector) output lagged, and net real agricultural imports. On the demand side, the relevant factors are total real private consumption expenditures, and other relative prices. The other two relative prices are the relative price of services and of petroleum. We have excluded the relative price of petroleum since domestic consumption is a very small part of total consumption, and petroleum products are not substitutes for agricultural goods.[16/] Another advantage of using this formulation is that it allows us to take into consideration the marketed surplus phenomenon. An increase in agricultural output increases the real income of farmers. This could lead them to increase their consumption (retention) of output on the farm. Thus it is conceivable that an increase in output could lead to an increase in relative prices if the income effect of increased output leads to a decline in the marketed surplus of output.

Another determinant of the demand for agricultural output is stocking behavior. We have no data on agricultural stocks and have to assume that some agricultural expenditures are for inventory accumulation. Inventory accumulation should be dictated by the behavior of the expected future price of the products and the rates of return on other investments including stocks of other products. We, unfortunately, do not have sufficient information or degrees of freedom to be able to include these factors in the regression.

Table VII presents the results of regressions for the agricultural terms of trade. In regressions VII.1 and VII.2, we regress the agricultural terms of trade on real private consumption expenditures, real agricultural output, the relative price of services, net agricultural real imports, and real government current expenditures. Real government expenditures are included in an attempt to find out if government subsidies and their effects on the relative price can be isolated. Imports and output are entered separately because output is in value added terms while imports are in gross output terms. We have no data on the value added to gross output ratio. On the whole, the regression does not do very well in terms of 't-statistics' especially when a correction is made for autocorrelation of the residuals. The regression results do indicate that the marketed surplus problem is not very important since an increase in output depresses prices. An increase in imports of agricultural products has the same effect. An increase in private real consumption expenditures increases the demand for agricultural products and leads to a rise in the relative price. The real government expenditures variable does not have the expected negative sign and is collinear with private real expenditures. One other interesting characteristic of the equation is the strong effect of the relative price of service products. This result indicates that service products and agricultural products are substitutes in some sense since an increase in the relative price of service products diverts expenditures from that sector to the agricultural sector and raises the price of agricultural products. 17/ The substitutability of agricultural products and service products can also be explained if the distribution of income is skewed and the data reflect market purchases of products which are dominated by the relatively well off for whom services are

TABLE VII

Agricultural Terms of Trade

			Constant	IPCONR	IGCONR	IPSIPN	IVAAR	IVAAR(-1)	INET MAG/IPA	$\bar{R}^2$	see/LHS	DW	ρ	RANGE
VII.1	IPAIPN	(OLS)	0.399 (0.503) [0.79]	0.0013 (0.0014) [0.95]	0.0005 (0.0017) [0.33]	0.879 (0.328) [2.68]	-0.00651 (0.0062) [-1.05]	- - -	0.0758 (0.581) [-0.14]	.36	3.7%	.87	-	1959-1973
VII.2	IPAIPN	(GLS)	0.973 (0.395) [2.46]	0.00061 (0.00082) [0.73]	0.0013 (0.00095) [1.41]	0.502 (0.263) [1.91]	-0.0069 (0.0042) [-1.65]	- - -	-0.150 (0.382) [-0.39]	.29	2.8%	1.17	.92	1959-1973
VII.3	IPAIPN	(OLS)	0.363 (0.469) [0.77]	0.002 (0.001) [1.35]	- - -	0.863 (0.309) [2.79]	-0.006 (0.006) [-1.07]	- - -	0.075 (0.334) [0.226]	.42	3.6%	0.95	-	1959-1973
VII.4	IPAIPN	(GLS)	0.657 (0.395) [1.67]	0.001 (0.00088) [1.20]	- - -	0.584 (0.286) [2.05]	-0.005 (0.004) [-1.15]	- - -	0.133 (0.305) [0.437]	.21	2.9%	1.11	-	1959-1973
VII.5	IPAIPN IPCONR replaced by 0.8 IPCONR + 0.2 IPCONR$_{-1}$	(OLS)	1.305 (0.729) [1.79]	0.0044 (0.0021 [2.14]	- - -	0.653 (0.365) [1.79]	-0.012 (0.006) [-1.89]	-.0099 (0.0059) [-1.67]	-0.574 (0.503) [-1.14]	.36	3.4%	1.27	-	1959-1973
VII.6	IPAIPN IPCONR replaced by 0.8 IPCONR + 0.2 IPCONR$_{-1}$	(GLS)	1.281 (0.522) [2.46]	0.00291 (0.00159) [1.83]	- - -	0.500 (0.273) [1.84]	-0.0103 (0.0052) [-1.98]	-0.0055 (0.0038) [-1.44]	-0.136 (0.353) [0.39]	.30	2.8	1.36	0.9	1959-1973

$\sum_i$ = -0.0158
(0.0083)
[-1.90]

SYMBOLS:
- ( ) denotes standard error
- [ ] denotes 't-statistic'
- DW: Durbin-Watson
- S.e.e: standard error of estimate
- LHS: mean of LHS variable
- ρ: parameter for first order autoregressive scheme
- IPAIPN: ratio of agricultural to industrial value added GDP deflators, 1959-100
- IPSIPN: ratio of service to industrial value added GDP deflators, 1959=100
- IGCONR: real government current expenditures in billions of 1959 rials
- IPCONR: private real consumption expenditures in billions of 1959 rials
- IVAAR: agricultural real value added in billions of1959 rials
- INETMAG: net agricultural imports in billions of rials
- IPA: agricultural GDP delfator, 1959=100

luxury goods but who will substitute other products for them at the margin.

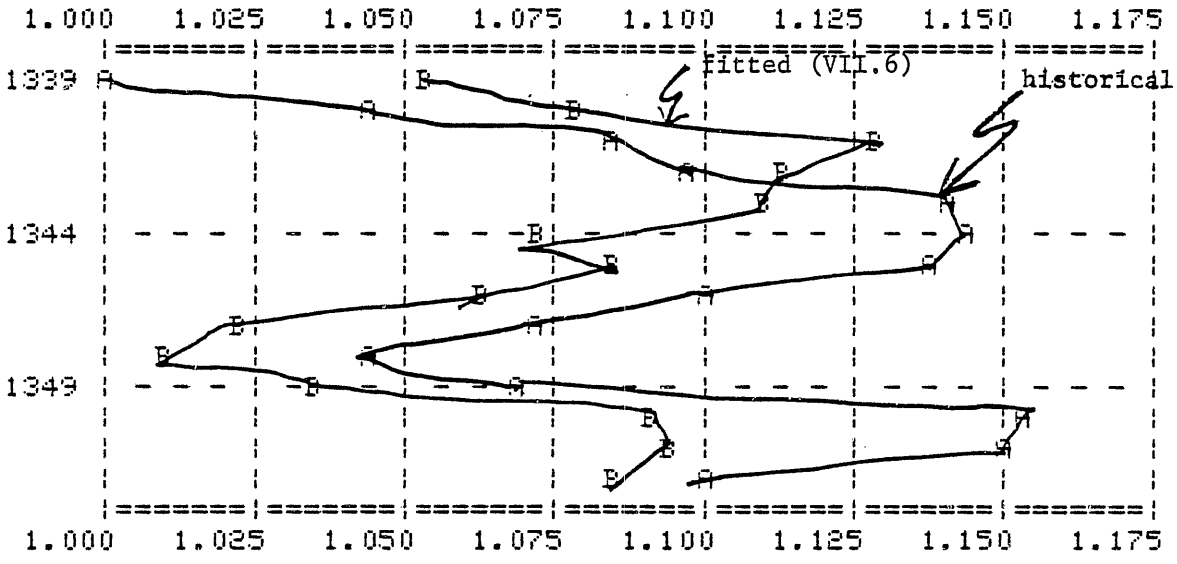
Dropping the government expenditures variables yields regressions VII.4 and VII.3. While dropping this variable leads to a slightly increased significance and a slightly higher value for real private expenditures variable, it also yields a positive sign for net agricultural imports. Although the latter variable has the wrong sign, it is insignificant statistically.

To improve upon the previous regressions, we added lagged values of some variables. To avoid loosing degrees of freedom as well as to minimize problems of collinearity, we allowed lagged agricultural output to enter in an unconstrained way while specifying a lag on private real consumption expenditures ex ante as having weight 0.8 in the current period and weight 0.2 in the past period. The results of these modifications are presented in regressions VII.5 and VII.6. Although none of the critical variables is "statistically" significant given the low number of degrees of freedom, the signs are all as expected and the standard errors are not too large.[18/]

Regression VII.6 suggests that the point elasticity of the agricultural terms of trade to a long-run change in output is -1.5. This is a fairly strong price effect. The point elasticity with respect to real private consumption is .89. (Both elasticities are calculated at the means.) These results indicate that secularly, production would not have to increase as fast as a real private consumption expenditures to maintain stability the agricultural terms of trade. In Iran during the period under consideration, however, agricultural production grew sufficiently slower than output to induce an increase in the agricultural terms of trade for certain intervals.

In all the relative price regressions, the regressions track well except for the period from 1962 to 1965. During this period the historical series rose and began to decline after 1965. The fitted series, however, falls during this period an all the regressions. The regressions do catch the cycle at the end of the period. (See Figure 1).

FIGURE I



B. The Nonagricultural Sector

The three nonagricultural sectors are the oil sector, the service sector, and the industrial sector. In the oil sector, both output and price trends are important. Price trends are important insofar as a rise in the relative price of oil with respect to other goods increases the ability of the country to purchase foreign products. Table VIII gives the real shares of the oil sector in GDP and of oil exports in total exports of goods in nominal terms and in real terms. Table VIII highlights the importance of the oil sector as a 'leading' sector of growth in the economy. Table VIII also brings out the crucial importance of oil exports for foreign exchange earnings.[19/] In real terms, value added in the oil sector increased at an annual compound rate of 14.0 percent between 1959 and 1972. In real terms, output did not grow between 1972 and 1973. Oil exports in constant prices grew at an annual compound rate of 10.8 percent. The GDP deflator for the oil sector increased at an annual compound rate of 2.1 percent between 1959 and 1972.[20/] From 1972 to 1973, it increased by almost 200 percent. The oil sector is an important component of aggregate output. Both its price and quantity produced are determined exogenously.

Real value added in both the service sector and industrial sector grew rapidly between 1959 and 1973.[21/] Value added in real terms grew at an annual compound rate of 12.0 percent between 1959 and 1972 in the industrial sector. During the same period real value added in the service sector grew at an annual compound rate of 9.8 percent. From 1972 to 1973, these sectors grew respectively by 16.8 percent and 13.1 percent in real terms. From 1959 to 1973, nonoil real GDP increased at an annual compound rate of 8.4 percent.

TABLE VIII

Oil in the Iranian Economy

	Real Share of oil sector value added to GDP (percent)	Share of oil exports to total exports of goods in real terms (percent)	Share of oil exports to total exports of goods in nominal terms (percent)	Non-oil exports in 1959 prices	Oil exports in 1959 prices
1959	16.5	86.5	86.5	7.7	49.4
1960	17.5	87.2	86.4	8.1	55.0
1961	18.5	86.3	85.6	9.4	59.1
1962	20.1	88.0	87.6	8.6	63.6
1963	20.7	87.9	87.5	9.7	70.4
1964	21.6	88.8	86.8	10.8	86.0
1965	21.7	88.7	86.8	12.9	101.4
1966	22.9	90.1	88.6	11.4	104.1
1967	24.0	92.1	90.7	13.0	150.7
1968	24.5	91.0	89.6	15.0	151.4
1969	25.8	91.0	88.9	16.2	164.8
1970	26.7	90.6	88.6	18.2	174.5
1971	27.0	86.5	87.0	21.9	141.4
1972	27.7	87.8	88.0	26.2	188.3
1973	27.7	83.3	89.8	28.6	143.0

To calculate constant price non-oil exports, non-oil exports are deflated by the GDP deflator for industrial value added.

Both these sectors increased their share of output in nonoil real GDP at the expense of the agricultural sector. As Table IX indicates, the share of service in nonoil GDP increased from 45.2 to 52.2 percent during the period. The share of industrial value added in nonoil GDP rose from 19.0 to 29.1 percent. To aid in our understanding of the behavior of real output (value added) in the service and industrial sectors, we show the results of reduced form regressions for these sectors in Table X.[22/] The exogenous variables that are used in these reduced form equations are government real current expenditures, government real capital expenditures, population, and oil exports in nominal terms.

Equation X.2 gives the reduced form results for real value added in the industrial sector (after correction for autocorrelation of the error term). An increase of 1 million in population leads to an increase of 6.45 billion rials (constant 1959 rials) in industrial value added with a 95 percent confidence interval of (5.1, 7.8). An increase in population acts on both supply and demand factors in the industrial sector. It increases the supply of these commodities by increasing the labor force. It acts as a stimulus to demand as well. This variable is also picking up trend increased in productivity due to additions to the capital stock.

On the expenditure side, the most important stimulus to nonagricultural output comes from government capital spending. The multiplier for government capital spending is 0.32. The multiplier for government current spending is 0.24 (we cannot reject the null hypothesis that the multipliers are equal, at the 5 percent significance level). These numbers suggest that government capital spending which adds to the infrastructure and the productive capital

TABLE IX

	Share of value added in service sector to real non-oil GDP (percent)	Share of value added in industrial sector to real non-oil GDP (percent)
1959	45.2	19.0
1960	45.2	19.6
1961	44.5	20.6
1962	42.5	21.6
1963	44.7	23.3
1964	46.4	22.8
1965	46.7	24.0
1966	48.1	25.2
1967	46.5	26.4
1968	47.1	26.8
1969	48.6	27.1
1970	50.2	27.0
1971	51.7	28.4
1972	52.0	28.0
1973	52.2	29.1

TABLE X

Reduced Form Equations

			Constant	IGCONR	IIPUBR	IPOP	IEXO	DW	ρ	$\bar{R}^2$	see/$\overline{LHS}$	Period
X.1	IVANAR		-114.32 (16.92) [-6.76]	0.25 (0.08) [3.29]	0.24 (0.13) [1.87]	6.79 (0.81) [8.43]	0.0078 (0.033) [2.42]	2.60	-	.998	2.3%	1959-1973
X.2	IVANAR	(GLS)	-106.97 (12.09) [-8.84]	0.24 (0.05) [4.53]	0.32 (0.09) [3.37]	6.45 (0.58) [11.18]	0.060 (0.027) [2.18]	2.36	-.54	.999	2.1%	1959-1973
X.3	IVASR		-92.14 (34.36) [-2.68]	0.95 (0.15) [6.12]	0.21 (0.26) [0.79]	7.91 (1.64) [4.83]	-0.04 (0.07) [-0.67]	2.08	-	.997	2.5%	1959-1973

Symbols:

( ) denote standard error
[ ] denote t-statistic
DW: Dubin-Watson
see: standard error of estimate
LHS: mean of LHS variable
ρ: parameter of first order autoregressive scheme
IVANAR: real industrial value added in billions of 1959 rials
IVASR: real service value added in billions of 1959 rials
IGCONR: real government consumption expenditures in billions of 1959 rials
IIPUBR: real government capital expenditures in billions of 1959 rials
IPOP: population in million
IEXO: oil export revenue in billions of reals

stock is an important determinant of growth in the industrial sector. Oil exports have a multiplier of 0.06. An increase in oil exports leads to a small increase in industrial value added to provide goods needed by this sector.

Table XI brings out the importance of industrial imports. The ratio of imports of industrial (manufactured) products to value added in the industrial sector is very high, generally over 60 percent. Exports of industrial commodities were becoming more important towards the end of the period but were still fairly minuscule. Imports were a significant source of supply of industrial goods. Since the principal sources of foreign exchange were exports of oil, oil exports contributed to the accumulation of capital in the industrial sector and its growth over time. Imports were the principal source of capital goods for the economy.

The role of government current and capital expenditures are reversed in the service sector. The government current expenditure multiplier for service value added is 0.95. The capital expenditure multiplier is 0.21. As was mentioned above, the capital multiplier was somewhat larger for the industrial sector. The current expenditure multiplier is not statistically different from 1.0. We can, however, reject (at the 5 percent level) the hypothesis that the capital expenditure multiplier is equal to 1.0. This suggests that government current expenditures provide service goods. The provision of this output has a multiplier effect on other sectors such as the industrial sector. The capital multiplier is not statistically different from zero. This suggests that not only do capital expenditures not provide capital for the provision of service output but that capital expenditures elsewhere in the economy do not

TABLE XI

Imports and Industrial Outputs

	exports of * nonag goods (billions of rials)	imports of * nonag goods (billions of rials)	net imports ** industrial value added (percent)	imports ** industrial value added (percent)
1959	0.5	32.9	71.5	72.6
1960	0.5	41.9	81.0	82.0
1961	0.6	37.4	69.0	70.2
1962	1.0	34.2	57.1	58.9
1963	0.6	31.2	46.9	47.8
1964	0.9	42.6	57.2	58.5
1965	1.3	54.5	61.8	63.2
1966	1.2	62.7	64.4	65.7
1967	1.5	80.5	70.7	72.0
1968	2.1	93.6	70.2	71.8
1969	3.2	104.5	67.4	69.5
1970	2.2	113.1	66.0	67.3
1971	3.3	122.7	58.2	59.9
1972	9.3	148.7	56.6	60.3
1973	26.6	197.5	51.4	59.4

* Nonag: nonagricultural

** Imports and net imports refer to imports and net imports of nonagricultural products.

increase the demand for service output substantially. The multiplier for oil exports which is -0.04 is also not significantly different from zero. This is expected because services are generally not imported so foreign exchange availability will have no effect on their supply.

The population multiplier for the service sector is 9.71 with a 95 percent confidence interval of (4.2. 11.6). This multiplier is larger than the population multiplier for the industrial sector which is 6.45. Since services tend to be more labor intensive than industrial commodities, one would expect the population variable to have a stranger effect on service output. For the two sectors combined, the government current expenditure multiplier is 1.19 and the capital expenditure multiplier is 0.53. The low values of the multipliers suggest that there are large leakages of income from these sectors into imports and the purchase of agricultural goods. Government spending does, however, have an expensionary effect on aggregate demand.

IV

THE DEMAND FOR AND SUPPLY OF CASH BALANCES

Aggregate prices were fairly stable during much of this period. From 1959 to 1970, the GNP deflator rose at an annual compound rate of only 1.3 percent. After 1970, however, prices began to increase quite rapidly. From 1970 to 1973, the GNP deflator rose at an annual compound rate of 8.0 percent. In an economy with a very simple and basic financial system, like Iran during this period, aggregate prices are determined by the demand for real cash balances and supply of nominal money. The money market cannot affect interest rates. Significantly interest rates are controlled and there are few alternative assets other than cash. The supply of nominal cash is determined by government expenditure policy. Through deficit finance or by spending revenue earned from oil exports, the government increases the nominal supply of cash. To the extent that the nominal supply of money increases faster than the demand for real cash balances, prices will rise. From 1970 to 1973, when the rate of inflation began to increase, M1 increased at an annual compound rate of 27.6 percent while real GNP grew at annual compound rate of 19.8 percent. The annual compound growth rates from 1962 to 1970 are 10.6 for real GNP and 11.3 percent for M1. (M2 grew at an annual compound rate of 19.3 percent from 1962 to 1970, and of 29.8 percent from 1970 to 1973.)[24/] We use regression analysis to examine the determinants of the supply of money and the demand for real cash balances.

Table XII shows the regression results for the supply of money and the demand for real cash balances regressions. These results indicate

TABLE XII

Money Demand

		Constant	IGNPR	$\Delta \ln(\text{IPGNP})_{-1}$	IINT	$\ln$ IGNPR	DW	ρ	R^{-2}	% See/$\overline{\text{LHS}}$	Period
XII.1	(IMON / IPGNP)*100	9.63 (5.74) [1.68]	0.115 (0.011) [10.75]	23.11 (76.85) [0.30]	-.440 (1.40) [-.31]	-	1.93	-	.97	6.8%	61-73
XII.2	$\ln$ (IMON/IPGNP)*100	-1.87 (0.32) [-5.86]	-	-0.235 (0.711) [-0.33]	-0.166 (.0138) [-1.20]	0.991 (0.061) [16.31]	2.06	-	.98	1.18%	40-52
XII.3	$\ln$ (IMON/IPGNP)*100	-1.78 (0.30) [-5.94]	-	-.56	-.0056 (.0061) [.91]	0.967 (0.054) [17.94]	2.26	-	.98	1.17%	40.52
XII.4	$\ln$ (IMON/IPGNP)*100 (GLS)	-2.006 (0.247) [-8.12]	-	-1.03	-.0103 (0.005) [-2.00]	1.008 (0.045) [22.50]	2.16	-.4	.99	1.11%	40-52
XII.5	ln (IMON/IPGNP)* 100	-49.18 (15.06) [-3.27]	0.334 (0.028) [11.88]	219.83 (201.56) [1.09]	1.62 (3.67) [0.45]	- -	1.68	-	.98	8.3%	40-52
XII.6	ln (ITMON/IPGNP)* 100	-4.32 (0.51) [-8.32]	-	-1.079 (1.152) [-.94]	-0.018 (0.022) [-.80]	1.49 (0.098) [15.16]	1.86	-	.98	1.6%	40-52
XII.7	ln (ITMON/IPGNP)* 100	-4.27 (0.47) [-9.1]	-	-1.0	-0.01 (0.009) [-1.30]	1.48 (0.08) [17.60]	1.95	-	.98	1.6%	40-52
XII.8	ln (ITMON/IPGNP)* 100 (GLS)	-60.32 (6.85) [-8.80]	0.369 (0.018) [20.45]	1.872 (131.23) [0.01]	1.30 (1.82) [0.72]	-	2.31	-1.0	.996	6.8%	40-52
XII.9	ln (ITMON/IPGNP)* 100 (GLS)	-4.70 (0.28) [-16.62]	-	-2.04 (0.65) [-3.16]	-0.0085 (0.011) [-0.79]	1.54 (0.05) [29.25]	2.12	-1	.996	1.3%	40-52
XII.10	ln (ITMON/IPGNP)* 100 (GLS)	-4.70 (0.27) [-17.43]	-	-1.7	-0.017 (0.006) [-3.10]	1.56 (0.05) [31.75]	1.81	-1	.996	1.31%	40-52

Money Supply

		Constant	IEXO	IGOVDEF	DW	ρ	R^{-2}	See/LHS	Period
XII.11	IMON	12.79 (3.56) [3.59]	0.31 (0.02) [28.39]	0.13 (0.10) [1.38]	2.08	-	.983	7.1%	61-73
XII.12	ITMON	-28.50 (13.53) [-2.10]	1.47 (0.08) [17.62]	0.57 (0.37) [1.54]	1.51	-	.970	12.4%	1340-52
XII.13	ITMON (GLS)	-19.90 (18.09) [-1.10]	1.41 (0.09) [15.16]	0.55 (0.39) [1.43]	1.85	.36	.952	11.9%	1340-52

SYMBOLS:
( ) denotes standard error
[ ] denotes 't-statistic'
DW: Durbin-Watson
ρ: parameter for first order autoregressive scheme
S.e.e: standard error of estimate
LHS: mean of the LHS variable
IMON: M1 in billions of 1959 rials
ITMON: M2 in billions of 1959 rials
IPGNP: GNP deflator, 1959=100
IGNPR: real GNP in billions of 1959 rials
IINT: discount rate in percent
IGOVDEF: government revenues minus government expenditures in billions of rials
IEXO: oil export revenue in billions of rials

that the nominal supply of money is an endogenous variable and that the critical determinant of the demand for real cash balances is real GNP.

Regressions XII.11 to XII.12 for the supply of money show the importance of the expenditure of oil revenues in determining the nominal supply of money. Regression XII.11 refers to narrow money while regression XII.12 refers to broad money M2. Regression XII.11 indicates that an additional rial of oil export revenue will produce an increase of 0.51 rials in M1 with a 95 percent confidence interval of (.46, .56). An increase in the government deficit of one rial, on the other hand, will lead to an increase in M1 of .13 rials with a 95 percent confidence interval of (-.10, .36). Clearly the effect of a deficit on the nominal supply of money can vary significantly and is not different from zero.[25/] The regressions for M2 show similar results. Government expenditure of oil revenue is a critical determinant of nominal M2. The effect of a one rial increase in the government deficit is less than one half the effect of a one rial increase in oil revenues and is not significiantly different from zero.[26/] The regressions indicate two results about the government's expenditure of oil revenues. First, a considerable portion of these revenues are expended on foreign goods or are sterilized. Given a money multiplier marginally larger than one with respect to reserve money, government expenditures of 1 rial of oil revenue must translate into less than .5 rials increase in domestic expenditures. Second, government expenditure of oil revenue domestically has to generate additional income and thus increase the demand for real cash balances if the resulting increase in the nominal money supply is not to be inflationary.

Regressions XII.1 to XII.10 give the results for the demand for real cash balances results. Regressions XII.1 to XII.4 use narrow money

while regressions XII.5 to XII.10 use M2. In all these regressions real balances are obtained by deflating nominal balances by the GNP deflator. The GNP deflator was used as an indication of transactions cost in the economy. The income variable is GNP in real terms. GNP was the prefered concept of income because it included the government's revenue from the oil sector which, for the most part, was spent while excluded factor payments abroad - mostly royalty payments to international oil companies. As such, GNP is the most accurate measure of internal transactions generating a demand for real cash balances.

Regressions XII.11 to X11.4 indicate that a constant income elasticity which is not significantly different from unity is the critical determinant of the demand for real cash balances. Entering income linearly gives marginally worse results in terms of $\bar{R}^2$ and s.e.e. Furthermore, a plot of the residual indicates that when income is entered linearly, the residuals tend to grow over time.

The expected rate of inflation and the discount rate have the expected signs. An increase in either variable leads to a decline in the demand for real cash balances. (Inflationary expectations are assumed to be purely static and equal to the immediate past change in the GNP deflator.) Statistically, we cannot reject the hypothesis that the interest rate and inflationary expectations coefficients are equal. When we constrain these coefficients to be equal, we obtain regression XII.4 - after correction for first order serial correlation. The coefficient has the expected sign and is significantly different from zero at the 10 percent level. The implied elasticity measured at the means with respect to the discount rate is, however, only -0.008. The implied elasticity with respect to the expected rate of inflation is even smaller. The constant

elasticity of the demand for real cash balances with respect to real income is still not significantly different from unity. These results indicate the critical determinant of the demand for real cash balances in the level of real income. (In 1969, oil exports in real terms were approximately 1/4 of real GNP. At the means, a 1 percent increase in oil exports leads to a .8 percent increase in the narrow nominal money supply. Since the increase in real oil revenues as a component of real GNP will increase the demand for real cash balances by approximately .25 percent (the share of real oil revenues) an additional increase in the other components of GNP amounting to over .5 percent of total real GNP is needed to absorb the increase in cash balances without inducing an increase in prices.) Towards the end of the period under discussion, oil revenues increased as both production and the price of oil rose. These factors increased the government expenditures out of oil revenues and increased the stock of narrow money. The other components of GNP - that is, components of GNP resulting from the use of capital and labor - could not increase as rapidly. As the growth of the nominal money supply accelerated, prices began to increase since the demand for real cash balances did not keep pace with the increase in the stock of money.

The regressions for the demand for real cash balances using the broad definition of money give similar results in that the crucial determinant of the demand for real cash balances is real income with an elasticity of approximately 1.5. In the linear specification, however, the expected rate of inflation and the discount rate both have a positive coefficient although it is not significantly different from zero for either variable. While the coefficient of the discount rate can theoretically be positive since interest is paid on some components of M2, the coefficient on the expected rate of inflation has the wrong sign. In the logarithmic form with a constant income

elasticity, both these coefficients are negative and are not significantly different from each other. When they are constrained to equal each other as in Regression XII.10, we obtain a significant coefficient. The implied interest elasticity is around -.02 while the implied inflationary expectations elasticity is around-.008. Both these numbers are extremely small in absolute terms and, again, the main determinant of the demand for real cash balances appears to be real income.

V

CONCLUSIONS

In this paper we have attempted to initiate a study of the dynamics of the development of the Iranian economy between 1959 and 1973. While this paper points out some of the distinctive features of growth, much more work is needed before these characteristics of Iranian growth can be fully understood and integrated in a comprehensive framework.

The trends which are pointed out by the paper are the growing importance of the government in aggregate consumption and investment decisions, the slow growth of the agricultural sector, the rapid growth of the service and industrial sector with the latter being heavily dependent on imports of manufactured capital goods, and finally the monetary implications of the domestic expenditure of oil revenue. The dramatic rise of petroleum prices after 1973 has further emphasised the role of government expenditures in the Iranian economy. To fully understand the impact of government policy after 1973, we have to be able to understand the dynamics of growth prior to that period. Finally, we have to understand more fully the behavior of the private sectors of the economy and its interactions with the government sector. The private sector will have to sustain long-run economic growth in Iran. An analysis of the pattern of development will help us understand what policies the government should implement to sustain development and growth even after the petroleum reserves are exhausted.

VI

APPENDIX

Originally, we intended to specify, estimate, and simulate a compact macroeconomic model of the Iranian economy from 1959 to 1973 to aid in our understanding of the development process, the sources of growth and the impediments to growth during this period. The nature of the data and the availability of various series precluded this option. Many series necessary for the estimation of a complete model were not available to us.

The nature of the data contributed to various estimation difficulties that we faced. Many of the data series were highly collinear as they were growing at trend with little or no variation around trend. (Part of this problem can be traced to the construction of the available series. Many of the statistical series are constructed by interpolation and projection from a small sample period, where almost all the basic data are available. For the entire period, data on only a small number of series is available. The other series are interpolated from this basic set. It is not surprising, then, to discover high collinearity between many of the series).

The small number of observations in the sample period combined with the collinearity of the basic exogenous variables that simultaneous estimation techniques could not be used. Any attempt to use instrumental variables would have resulted in an almost perfect fit in the first stage. A tight fit in the first stage would yield OLS estimates in the second stage.

Collinearity problems also contributed to the estimation of equations which are probably mis-specified. Given the trend growth of many variables, lagged values could not be included in the regression. At times,

the collinearity problem also implied that two separate variables, each of which ought to be in the regression, could not be entered simultaneously.

Given these data problems, the regression strategy was to estimate certain basic relationships and their behavior for the period under consideration. These estimates aid in an understanding of the aggregate behavior of the Iranian economy from 1338 to 1352. They are by no means powerful tests of the various behavioral relationships which are postulated. The regression results which we have obtained give us a better understanding of the behavior of private real consumption, private real investment, the demand for real cash balances, the behavior of the agricultural terms of trade, the supply of nominal cash balances, and finally, the effect of real government expenditures on growth.

VII

FOOTNOTES

1/ The data are in Iranian calender year. Thus '1959' refers to the Iranian calender year '1338' which is equivalent to March 21, 1959 to March 20, 1960. Recently, the numbering of calender years in the Iranian calender has been changed. 1354 is now referred to as 2534.

2/ All constant price 'real' quantities are in 1959 (1338) prices.

3/ The compound growth rate from 1959 to 1973 was 9.8 percent a year. this rate reflects the growth rate of 12.5 percent in annual terms between 1972 and 1973.

4/ Some of the statistical exercises will use real GNP at market prices as an explanatory variable. Between 1959 and 1971 real GNP at market prices moves exactly as real GDP as factor cost does. After 1971, however, these series begin to diverge. After 1971, petroleum prices began to increase. By 1972, real GDP and real GNP begin to behave quite differently since real GNP increased faster than real GDP. The real rate of growth between 1972 and 1973 is 34.0 percent for GNP and 12.5 percent for GDP. This difference is accounted for by the addition to real GNP in the national accounts of a "terms of trade" adjustment of 15.6 percent of real GNP at market prices. (In our data, we express this as a much slower increase in the GNP deflator as opposed to the GDP deflator.) In 1973/74 (1352), the price of petroleum nearly doubled. The national accounts treatment of increases in oil prices (or other primary products) is a problematic index number problem. The construction of an index with the appropriate weights and prices, would eliminate the problem. This is beyond the scope of this paper. The crucial point, is that this change in prices increased Iran's welfare. The annual compound growth rates for GNP are 9.2 percent between 1959 and 1972 and 10.8 percent between 1959 and 1973.

5/ An attempt to use other price deflators such as the GNP deflator failed because of the rapid increase in petroleum prices towards the end of this period and the index number problem mentioned earlier. Using this price series to deflate income resulted in a negative MPC.

6/ The government revenue series used here is the one presented in the Central Bank Bulletin. The series was revised downwards in 1960/61 (1339) with no explanation given for the revision. We constructed compatible figures for the earlier years by shifting down the value for the prior year by the ratio of revised to unrevised data in 1960. This issue still leaves open the possibility that some items are not officially part of the government revenue statistics but which do accrue to the government. To the extent that this is true, our approximation overstates private income.

7/ Using a dummy variable equal to 1 in one year and 0 in all other years is the exact equivalent of dropping that year in the sample used to estimate the other coefficients. The regression will fit the data exactly in the year when the dummy variable equals 1.0. (The residual is identically equal to 0 in that year.)

8/ For the reasons given in Footnote (7), the statistical significance of the dummy variable is to be expected. What is interesting is that this variable has a negative coefficient.

9/ Several other regressions were also run. Table I shows the results of regressions excluding the interest rate as an explanatory variable. (I.6 and I.7). Dropping the interest rate raises the auto-correlation of the error term as measured by the Dubin-Watson statistic. The increase in the Dubin-Watson statistic can be seen as an indication of mis-specification.

10/ Separate deflators for private investment and for public investment are not available after 1972. For 1973, both private and public investment are deflated by the total investment deflator.

11/ The regression results might be biased by the fact that real GDP for 1973 does not include a 'terms of trade' effect to reflect the massive rise in the price of petroleum. It is difficult to see, however, why a rise in petroleum prices should lead to increased private investment. While this price rise will raise the marginal product of petroleum capital goods with respect to other capital goods, the oil sector is a government sector.

12/ The equation might be misspecified since the private capital stock is used to produce only private output. Thus, output originating in the public sector which is dominated by petroleum might not affect the desired private capital stock. We use GDP which includes output originating in the government sector because private expectations of the sustainable level of private output are influenced by the level of government output. This is particularly important since the major source of foreign exchange is the government owned petroleum sector.

13/ These formulations of the investment function are very crude and naive. The estimation procedures are fairly crude as well since the important simulataneity between income and investment is ignored. The standard errors of estimate of all the estimated regressions are fairly large (on the order of magnitude of 10 percent). None of the estimated regressions are fairly large (on the order of magnitude of 10 percent). None of the estimated regressions catches the few turning points that occur in the actual series.

14/ The estimated coefficient should not be regarded as a measure of the capital-output ratio. Let - using a stock adjustment model -

(*) $I_t = (u)\, Q_{t-1} - (u\gamma)\, K_{t-1}$

where I_t = gross investment; u = adjustment coefficient (how much of the gap between desired and actual capital stock is made up in the current year);

γ = depreciation proportionality constant;

K_{t-1} = capital stock in $t-1$;

Q_{t-1} = output in $t-1$

If $K_{t-1} \approx \alpha\, Q_{t-1} + e$ with e being an error term

then

$I_t \approx \alpha\, \gamma Q_{t-1} + u.$

Thus the coefficient of Q_{t-1} is the capital output ratio times the depreciation constant which is smaller than 1.

Table A.1 gives the ratios of private and total real investment lagged to the change in real GDP and real non-oil GDP. These ratios are all functions of the various sectoral incremental capital - output ratios in the economy. It is interesting to note that these measures all decline over time.

Footnote 14/ continues

Table A.1

Incremental Capital-Output Ratios

	$\frac{\text{private real investment}_{-1}}{\Delta \text{ real GDP non-oil}}$	$\frac{\text{private real investment}_{-1}}{\Delta \text{ real GDP}}$	$\frac{\text{total real investment}_{-1}}{\Delta \text{ real GDP non-oil}}$	$\frac{\text{total real investment}_{-1}}{\Delta \text{ real GDP}}$
60	2.8	1.8	4.6	3.0
61	5.7	3.2	8.5	4.8
62	3.0	1.6	4.8	2.6
63	2.1	1.5	3.4	2.4
64	1.5	1.0	2.6	1.8
65	1.1	0.9	1.7	1.4
66	1.8	1.1	3.4	2.1
67	1.3	0.9	2.4	1.6
68	1.3	0.9	2.5	1.8
69	1.5	0.9	3.4	2.1
70	1.0	0.7	2.6	1.7
71	0.8	0.6	2.1	1.5
72	1.0	0.7	2.3	1.5
73	1.1	0.8	2.6	1.7

15/ We ignore the fact that some agricultural prices are controlled. We have no data on administered prices.

16/ Petroleum prices could, however, affect the price of agricultural products by affecting the price of inputs such as fertilizer.

17/ This is one instance in which simultaneous equations bias can be an important consideration. We can think of the service sector as a residual sector with the price of services being determined by the price of labor. The price of labor is, to some extent, determined by the price of wage goods, namely agricultural products. Thus an increase in the relative price of agricultural products will induce an increase in the price of labor and lead to a rise in the price of service sector goods. There is a strong positive bias in the coefficient of the relative price of agricultural goods.

Simultaneous equation bias is also important to the extent that output and imports of agricultural commodities are price sensitive. Price sensitivity of these supply factors will give a positive bias to the OLS estimated coefficients of imports and value added in the relative price regression. Thus both these coefficients might be more negative than the estimates in Table VII indicate.

18/ From these regressions we can get an approximation to the gross output to value added ratio if we assume that the effects of increased output and increased imports are similar. Of course, they are not similar since increased output has an income effect on agricultural producers who reduce their marketed surplus. The ratio is 11.6.

19/ Until 1973, the nominal and real shares of oil exports behave quite similarly. This suggests that until 1973, oil prices were not behaving very differently from other prices given that in non-oil exports Iran is a price taker. Oil exports were decreasing somewhat in price relative to other export prices before 1973.

20/ Oil prices fell at an annual compound rate of 2 percent between 1959 and 1965. They increased at an annual compound rate of 6 percent between 1965 and 1972.

21/ The industrial sector includes manufacturing and mining, construction, and water and power. The service sector is composed of transportation and communication; banking, insurance and brokerage; trade; housing rent; public services; and private services.

22/ These regressions should be seen as only gross approximations to the true reduced form regressions. The regressions results presented here do not include any lagged variables as explanatory variables. The collinearity problems between the exogenous variables precluded the use of lagged values. Furthermore, the regressions are linear in all variables. The underlying structural model appears to be nonlinear. This suggests that linear reduced form regressions should be treated as linear approximations to the true reduced form equations, even if they are correctly specified in terms of all variables that enter the relationships.

23/ The GNP deflator and the private consumption deflator behave quite similarly. The consumption deflator increased at an annual compound rate of 1.6 percent between 1959 and 1970. Between 1970 and 1973 it rose at an annual compound rate of 7.3 percent. The GNP deflator which is used in this section to deflate cash balances does not reflect fully the increase in oil prices in 1973. (See Footnote 4.)

24/ M2 is defined as M1 plus quasi-money.

25/ The regression is misspecified as only the part of the deficit financed by money creation ought to enter the regression.

26/ While the M1 regression does not show strong evidence of autocorrelation of the error term, the M2 regressions show some degree of serial correlation. Insofar as that serial correlation is an indication of misspecification, the government's expenditures of oil revenue determine the stock of narrow money which interacts with other variables to determine the stock of broad money.

DATA SOURCES

1. Bank Markazi Iran, National Income of Iran, 1338-50 (1959-72). 1353.

2. Bank Markazi Iran, (The Central Bank of Iran), Annual Report and Balance Sheet; Various Issues.

3. The Imperial Government of Iran, Ministry of Commerce. Foreign Trade Statistics of Iran; Various Issues.

4. The Imperial Government of Iran, Plan Organization. Statistical Yearbook, 1966.

5. _____. Statistical Yearbook, 1970.

6. _____. Statistical Yearbook, 1972.

DOMESTIC FINANCE STUDIES

#25. Public Sector Enterprises in India: A Descriptive Survey. October 1976. S. Bery.

#26. Revenue Policy for Thailand: Income, Sales and Property Tax. October 1976. W. S. Kee.

#27. An Estimation of the Household Sector Savings of Sri Lanka. August 1976. K. Saito.

#28. The Unorganized Financial Sector in Korea, 1945-75. November 1976. Y. C. Park.

#29. Contractual Savings and the Mobilisation of Resources. November 1976. P. Shome.

#30. Tax Evasion and Avoidance: A Crucial but Neglected Aspect of Taxation. December 1976. J. N. Sharma.

#31. Aspect of Savings Behavior in Rural India. December 1976. Surjit Bhalla.

#32. The Incidence of the Corporation Income Tax: A Fixed Endowment, Specific Factor Model. January 1977. P. Shome.

#33. On Monetary Data and Analysis. February 1977. V. V. Bhatt,

#34. A Program of Research on Finance and Development. March 1977. R. S. Eckaus.

#35. The Determinants of Savings Behavior: A Survey of the Evidence. March 1977. K. Saito.

#36. Some Project Issues in Indexation of Financial Contracts. April 1977. Shahid Yusuf.

#37. Meeting Basic Needs in Malaysia: A Summary of Findings. April 1977. Jacob Meerman.

#38. The Impact of Contractual Savings on Resource Mobilisation and Allocation: The Experience of Malaysia. April 1977. K. Saito and P. Shome.

#39. The Commercial Banking Industry in Brazil 1964-1974. May 1977. Shahid Yusuf.

#40. Enterprise Control in the Soviet Union and China: The Futility of Lessons. June 1977. Shahid Yusuf.

#41. Bank Behavior and the Control of Credit Flows: Lessons from the Sri Lanka Experience. June 1977. J.K.S. Ghandi.

#42. The Distribution of Public Expenditure for Education and Agriculture in Malaysia Methodological Issues and a New Approach. October 1977. Jacob Meerman.

#43. Division of Public and Private Finance: Research Program and Its Rational. October 1977. V. V. Bhatt.

#44. Understanding Self-Management in Yugoslavia. November 1977. Shahid Yusuf.

#45. A Statistical Analysis of the Dynamics of Economic Growth in Iran: 1959-73. December 1977. W. A. Dellalfar and J. Khalilzadeh-Shirazi.