Chapter 5: Private Investment within a Macroeconomic Framework

5.0.0: Introduction

In chapter 3, private investment has been analyzed within a single equation framework. The single equation regression analysis results suggest that government borrowing from the banking system could have occasionally 'crowded out' private investment. Our results in chapter 4 suggest that there is a positive relationship between deposit rates and financial savings, and between financial savings and credit, and therefore private investment. On the other hand, we find evidence that credit is negatively related to the lending rates. Further in chapter 3, we found weak relationship between public investment and private investment, perhaps on account of problems related composition of public investment in Kenya. We have argued that the results may suggest that public investment affects private investment through the impact on profitability. One important question that still remains, relates to the net impact of these seemingly 'conflicting effects' of public policy on private investment and related macroeconomic variables. For example, high interest rates may have a positive impact on financial savings and thus on credit, however, the high lending rates may lead to reduced credit due to the high cost of borrowing. In this case, the question as to the net impact on private investment is important. The aim here is to build a model which describes the behavior of the Kenyan macro economy over an extended period of time and use this model for computer simulations to analyze these policy questions. Specifically we try to analyze the 'complementary' and 'crowding out' aspects of public policy discussed in chapter 3 and 4, within a macroeconomic framework.

Our investment function relates private investment to returns, availability of credit, variability or instability and capacity utilization. These variables have been discussed in chapter 3 and chapter 4. The availability of finance (in the form of credit or returns on investment) *is a necessary but not sufficient condition* for private investment to take place, in addition entrepreneurs should be convinced that there is an adequate flow of expenditure to purchase what is produced and allow for some profit. Consequently expenditure flows in an economy are relevant for investment decisions. This brings into focus the expenditure flows in an economy. In chapter 1, we have briefly discussed how investors' incomes are related to expenditure flows in the economy (see, chapter 1; equation 1.3). This link between investors' incomes and expenditure flows is central in our macroeconomic analysis of investment behavior. The credit variable in the investment function and its links to other financial variables discussed in chapter 4 form the basis for further expansion of the model.

5.1.0: The Macroeconomic Model

The model is a set of simultaneous equations relating endogenous (dependent) variables to the exogenous (independent variables) and policy instruments. The most important policy instrument variables for the purpose of this study are: government borrowing from the commercial banking system, the treasury bill rate and public investment. In Kenya, since interest rates have been liberalized, the treasury bill rate depends much on government borrowing from the public. There are 16 behavioral equations that are estimated econometrically from historical data, generally covering the period 1975-1994. The exogenous variables include: prices of exports and imports, money supply, exchange rate, world CPI, deflator for consumption and public sector expenditure. There are also lagged dependent variables that are determined within the model. The model may be extended appropriately

since every equation that is introduced introduces new variables that may not be treated as exogenous.

This model differs from the existing macro econometric policy model for Kenya[66] in a many ways. The existing model specifies private investment as a function real exports , foreign reserves as a ratio of imports, growth and average real credit to the private sector. This is different from the investment relationships discussed in the previous chapters. Generally, the existing model is more dis-aggregated than this current model. The other important difference are in the specification of the interest rate, credit and financial saving equations. As for the implementation of the model, the current model is written in RATS 4.31 for windows providing a better testing environment than the existing model which is written in LOTUS 123. Bellow is a summary of the current model.

5.1.0.1: A Summary of the Model Equations

Identities and Restrictions

1. $GDP = PRCON + I + G + X - Y - M$
2. $\pi = PRCON + I_P + G + X - M - TA - w.L$
3. $K = K_{t-1} - \delta(K_{t-1}) + GROSINV$
4. $GROSINV = I_P + PUBINV + CHSTK$
5. $PRCRE = CRED - PUCRE$
6. $GDPP = -268.96 + .4190K$
7. $UTIL = \frac{GDP}{GDPP}$

Behavioral Equations

8. $I_P = \alpha + a_1 \frac{\pi}{K} + a_2 CRP + a_4 UTIL + a_5 VAR + \varrho_1$
9. $CHSTK = \varphi_1 + \varphi_2 CHTSK2 + \varphi_3 GROWFC + \varphi_4 GROWFC_{t-1} + \varrho_2$
10. $CRED = \beta + \beta_1 SA + \beta_2 LENDR + \beta_3 Y + \varrho_3$
11. $SA = b_1 + b_2((DEPOR + DEPOR\{1\}/2)_{t-1} + b_3\pi + b_4 SA_{t-1} + \varrho_b$

[66]The Ministry of Economic Planning and Finance maintains a macro econometric model which is a revised a version of the first model constructed in 1982. This model is described in Chakrabarti S. K., *Macro Economic Policy Model for Kenya, Version II. An Explanatory Manual:* Ministry of Finance and Office of the Vice President and Ministry of Planning and National Development, 1994.

12. $LENDR = c + c_1 TBRATE + c_2 LENDR_{t-1} + \varrho_c$
13. $DEPOR = d + d_1 TBRATE + d_2 DEPOR_{t-1} + \varrho_d$
14. $CONSP = \gamma + \gamma_1 \pi C + \gamma_2 wC + \varrho_4$
15. $X = \delta + \delta_1 P_X + \delta_2 Y + \varrho_5$
16. $M = d + d1DOM + d2PM + \varrho_6$
17. $TAXC = \theta + \theta_1 GDPTC + \varrho 7$
17. $WCOST = \rho + \rho_1 CPI + \rho_2 WCOST_{t-1} + \varrho_8$
28. $CPI = \sigma + \sigma_1 PM + \sigma_2 M2/Y + \sigma_3 WCOST + \sigma_4 UTIL + \varrho_9$
29. $GDPDEF = \varsigma + \varsigma_1 M2/Y + \varsigma_2 PM + \varsigma_3 WCOST_{t-1} + \varsigma_4 UTIL + \varrho_{10}$
30. $KDEF = \varphi + \varphi_1 PM + \varphi_2 GDPDEF + \varphi_3 KDEF_{t-1} + \varrho_{11}$
31. $EMP = \phi + \phi_1 WCOST + \phi_2 T + \phi_3 GROWFC + \phi_4 K + \varrho_{12}$
32. $DEFTAX = \nu_1 + \nu_2 PM + \nu_3 CPI + \varrho_{13}$

The estimated equations are shown below. Most of the equation are estimated by generalized instrumental variables technique or 2 Stage Least Squares correcting for first order serial correlation where necessary. Where dummies are included to explain certain phenomenon or aspects of the Kenyan economy, they are discussed for each equation. T statistics are given in parenthesis below the relevant estimated coefficient. In the equations below [AR1-INST] implies estimation by the Instrumental Variable Technique correcting for first order serial correlation; CORC implies Cochrane-Orcutt Technique and INST simply a generalized instrumental variable estimation.

Structural Equations

1. $I_P = -1851.67 + 10.79(\pi/K + (\pi/K)_{t-1})/2 + .28PRCRE + 1660.56UTIL/UTIL_{t-1} + .63I_{P_{t-1}} - .25VAR$
[77-94] (-6.9) (5.5) (4.8) (7.6) (6.6) (-1.9)
$R^2 = .86; \bar{R}^2 = .79; RHO = -.57; Q(4-1) = 4.1; DW = 2.23$ [AR1-INST]

2, $CRED = -57.03 + .49SA - 14.51INTRE + .23(GDP + GDP_{t-1})/2$
[76-94] (-.7) (3.1) (-4.4) (8.1)
$R^2 = .96; \bar{R}^2 = .95; DW = 1.95$ [INST]

3. $CHSTK = 187.79 + .89(CHSTK_{t-1} + CHSTK_{t-2})/2 + 1252.62\Delta Y - 1055.21\Delta Y_{t-1}$
[78-94] (0.4) (4.9) (1.9) (-1.8)
$R^2 = .78; \bar{R}^2 = .64; RHO = -.56; Q(4-1) = .77; DW = 1.7$ [AR1-INST]

4. $SA = -787.60 + 13.27(DEPOR + DEPOR_{t-1})/2 + .72\pi + .48SA_{t-1}$
[78-94] (-4.3) (2.6) (4.8) (3.4)

$R^2 = .94; \bar{R}^2 = .92; Q(4-1) = 5.9; DW = 1.98$ [AR1-INST]

5. $LENDR = 2.62 + .64TBRATE + .43LENDR_{t-1}$
[77-94] (8.9) (18.35) (9.2)
$R^2 = .98; \bar{R}^2 = .98; Q(4-1) = 3.3; RHO = -.09$ [CORC]

6. $DEPOR = 2.71 + .46TBRATE + .21DEPOR_{t-1}$
[76-94] (5.4) (14.8) (4.0)
$R^2 = .98; \bar{R}^2 = .97; Q(4-0) = 3.2$ [INST]

7. $CONSP = -1021.29 + .38\pi C + 1.37(wC + wC_{t-1})/2 + .95SA$
[77-94] (-3.2) (4.2) (8.6) (3.1)
$R^2 = .99; \bar{R}^2 = .99; DW = 1.96;$ [INST]

8. $X = -1197.67 + 0.01P_X + .36Y$
[77-94] (-1.9) (10.3) (3.6)
$R^2 = .98; \bar{R}^2 = .97; DW = 2.8; RHO = .88;$ [AR1-INST]

9. $M = -3928.87 - 345.02(P_M/CPI + P_Mt_{-1}/CPI_{t-1})/2 + .75DOM$
[76-94] (-6.2) (-2.4) (13.5)
$R^2 = .97; \bar{R}^2 = .97; DW = 2.0; RHO = .94;$ [AR1-INST]

10. $GDPDEF = .21 + .07PM + .68M2Y + 54.44w$
[76-94] (4.9) (5.7) (3.3) (17.86)
$R^2 = .99; \bar{R}^2 = .99; DW = 1.5; RHO = .73$ [CORC]

11. $\ln CPI = 2.49 + .14 \ln PM + .25 \ln M2Y_{t-1} + 1.08 \ln w - 1.07 \ln UTIL$
[77-94] (8.8) (3.1) (3.8) (9.8) (-3.6)

$R^2 = .99; \bar{R}^2 = .99; DW = 1.6; RHO = .89$ [CORC]

12. $KDEF = -13.57 + .13PM + .67GDPDEF + .42KDEF_{t-1}$
[76-94] (-2.1) (2.4) (3.3) (3.3)

$R^2 = .99; \bar{R}^2 = .99; DW = 2.1; F = 2208.16;$ Q(4-0) = 6.2 [INST]

13. $\ln L = 4.7 + .05 \ln \Delta Y + .18 \ln K - .42 \ln w_{t-1} + .07T$
[78-94] (7.9) (2.8) (2.6) (-3.7) (5.8)
$R^2 = .99; \bar{R}^2 = .99; DW = 2.1; F = 823.4, RHO = .40;$ [AR1-INST]

14. $\ln w = -1.05 + .67 \ln w_{t-1} - .29(\ln CPI + CPI_{t-1})/2$
[77-94] (-5.1) (10.2) (5.5)
$R^2 = .99; \bar{R}^2 = .99; DW = 1.9; F = 3289.6; RHO = .06;$ [CORC]

15. $TAX = -615.19 + .42GDPT - 43.57T$
[76-94] (-3.9) (8.9) (-4.5)
$R^2 = .96; \bar{R}^2 = .95; RHO = .47;$ [CORC]

16. $.DEFTAX = -14.23 + 1.13GDPDEF$
[77-94] (4.6) (5.8)
$R^2 = .99; \bar{R}^2 = .99; RHO = .72;$ [AR1-INST]

Variables	Description
I_p	Real Private investment K£ million
π	Deflated Nonwage incomes less depreciation less traditional sector GDP
w	Wage rate
wC	Nominal wage incomes K£ million
πC	Nominal nonwage incomes K£ million
GDPP	Capacity output K£ million
PRCRE	Real Credit to the private sector
CRED	Total Real Bank Credit (K£ mn)
DOM	Domestic incomes in terms of expenditure on domestic Output
PUCRE	Real Credit to the public sector (K£ mn)
LENDR	Commercial Bank lending Rate
DEPOR	Commercial Bank Saving Deposit Rate
GROWFC	Growth in real Incomes (Y)
PRCON	Real Private Consumption K£ million
NCONSP	Nominal Private Consumption K£ million
X	Total Exports of goods and services (Constant 1982 prices)
M	Total Imports of goods and services (Constant 1982 prices)
PM	Import Price index as a ratio domestic prices
Y	Real Incomes at Factor Cost K£ million
TBRATE	Interest on 90 days treasury bill
K	Capital Stock (Constant 1982 prices)
TAX	Net Indirect taxes at constant prices K£ million
TAXC	Net Indirect taxes (current prices) K£ million
GDP	GDP at Market prices K£ million (Constant 1982 prices)
L	Total Employment (Modern sector, 000)
CPI	Consumer price index
WCPI	World Consumer Price Index
CHSTK	Change in stock K£ million
GDPDEF	GDP Deflator

KDEF	Deflator for investment
DEFTAX	Deflator for indirect taxes
GROSINV	Real Gross Investment K£ million
M2Y	Money Supply as a ratio of GDP
PUBINV	Real Public Investment K£ million
G	Government Expenditure (both consumption and Investment) K£ million
CHSTK	Change in Stocks K£ million
SA	Real Financial Savings
ϱ_f	Random term
δ	Capital consumption (Depreciation)
T	Time Trend

5.0.2.1: The Rationale for the Model

The above econometric model combines important issues raised in the previous chapters that can be converted into an empirical mathematical model on account of available data. In the model, output is assumed to be determined from the demand side of the economy. That is output is determined by the components of demand: consumption, investment, government expenditure and net exports. However, we recognize that effective demand may be constrained and as a result we introduce the supply side by incorporating capacity utilization in our model. The capacity output is assumed to be a function of capital stock. An important aspect of this model is in the recognition that total incomes can be broadly divided between wages and wage incomes. The latter being important for the growth of the capitalist economic system. Note that profit is a component of non-wage incomes.

As discussed in chapter 1, from basic macroeconomic relationships, non wages are identical to the expenditure components of output less taxes and wages. Which can be formally expressed as:

$$\pi = PRCON + I_P + G + X - M - TAX - w.L$$

Where *PRCON* is private consumption exenditure, I_P is private investment expenditure, G is government expenditure, *X-M* is net exports, *TAX* is indirect taxes and $w.L$ is wages.

This represents an important relationship between enterpreneurs' incomes, expenditure flows and taxes and wages. In the investment function, the returns variable is the nonwage incomes deflated the investment deflator to take in to account the cost of capital goods adjusted for depreciation and GDP in the traditional sector as a ratio of capital stock. In the model, the right hand side variables are modeled thus providing a means through which the expenditure components are related to the returns of investors.

The importance of the banking or financial sector in investment decisions is modeled through equations describing financial savings, credit to the private sector and interest rates. The importance of the financial sector for investment has been discussed above in chapter 4.

As any other macroeconomic model, our model is a set of simultaneous equations describing definitional and behavioral links between economic variables. The coefficients are estimated econometrically using historical data generally covering the period 1975-1994. A discussion of individual equations follow below.

5.1.1. Private Investment and Credit Equations

The justification for the specification of the investment function has been discussed in detail in chapter 3 and thus only deserves mention. We relate real investment rate to the rate of return (real nonwage incomes less depreciation less traditional sector output as a ratio of capital stock), total credit less credit to the public sector (that is, private sector credit is obtained as a residual), capacity utilization and a measure for stability.

The variables included in the investment function and the justification has been discussed in chapter three above. In view of the suitability of the equation within the framework of the complete set of simultaneous equations for simulations, the following equation was selected.

$$I_P = -1851.67 + 10.79(\pi/K + (\pi/K)_{t-1})/2 + .28PRCRE + 1660.56UTIL/UTIL_{t-1} + .63I_{P_{t-1}} - .25VAR$$

[77-94] (-6.9) (5.5) (4.8) (7.6) (6.6) (-1.9)

$$R^2 = .86; \bar{R}^2 = .79; RHO = -.57; Q(4-1) = 4.1; DW = 2.23$$

Credit to the private sector in our investment function and for computer simulations, is obtained as a residual, that is, the share of bank credit to the private sector is obtained as total credit (CRED) less credit to the public sector share (PUCRE). The assumption behind this specification is that as the capacity of the banking system to provide credit grows, the share of credit to the private sector is likely to grow but government borrowing may result in a reduced share for the private sector. Public sector credit is autonomously determined. As discussed in chapter 4, total credit is a function of the capacity of the banking system to give credit (real financial savings), the lending rate and output as an indicator of the level of economic activity. All the variables came out with the expected signs and are statistically significant[67].

An additional equation that is related to credit creation is the equation for real financial saving. Real financial saving is a function of saving deposit rate and real business incomes (nonwage incomes) and lagged financial savings (this takes into account, institutional factors). This equation is also discussed in Chapter 4. In the model we also have equations for interest rates, both lending and savings rate.

Since the Kenyan financial market is not highly diversified, movements in bank rates (both lending and savings) move closely with movement in the treasury bill rate[68]. Thus in modeling interest rates, we relate them to the treasury bill rate and dummies for the years that

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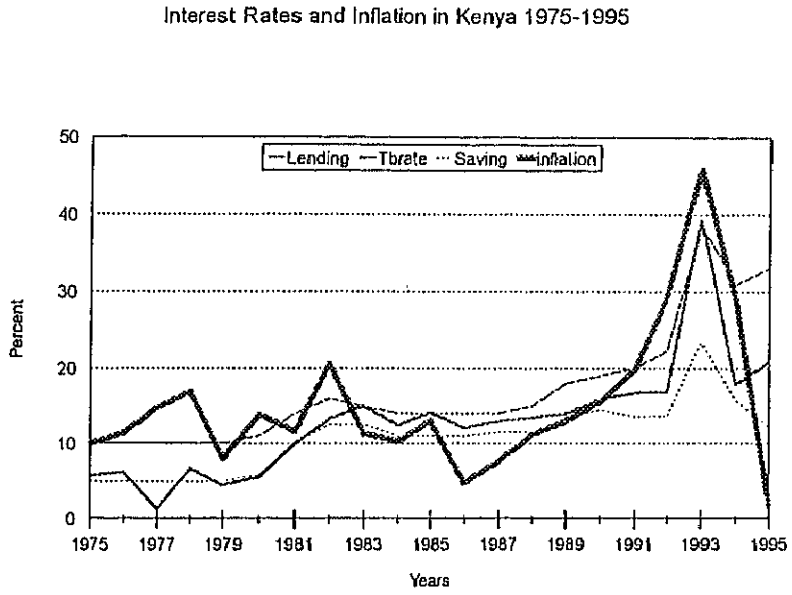
[67]The issue of possible collinearity between the activity variable Y and the capacity of the financial system to give credit is discussed in Chapter 4.

[68]The movement in the treasury bill rate are mainly related to borrowing activities or contact of monetary and fiscal policy. So we have treated it as an exogenous variable.

monetary authorities made significant adjustment on the interest rates. The chart below shows movements in the treasury bill rate, lending rate, saving rate and inflation.

Chart 5.1: Interest Rates and Inflation in Kenya, 1975-1995



Data Source: Central Quarterly Economic Report, 1994 and Economic Survey, 1997., Republic of Kenya

The following equations briefly describe the working of the banking system in Kenya in relation to the provision of credit to the private sector.

$$CRED = -57.03 + .49SA - 14.51INTRE + .23(GDP + GDP_{t-1})/2 + 98.00ELECT + 107.74D8081$$
[76-94] (-.7) (3.1) (-4.4) (8.1) (2.9) (3.0)

$$R^2 = .96; \bar{R}^2 = .95; DW = 1.95$$

$$SA = -787.60 + 13.27(DEPOR + DEPOR_{t-1})/2 + .72\pi + .48SA_{t-1}$$
[78-94] (-4.3) (2.6) (4.8) (3.4)

$$R^2 = .94; \bar{R}^2 = .92; Q(4-1) = 5.9; DW = 1.98$$

$$LENDR = 2.62 + .64TBRATE + .43LENDR_{t-1} - 3.04D8388$$
[77-94] (8.9) (18.35) (9.2) (-5.7)

$$R^2 = .98; \bar{R}^2 = .98; Q(4-1) = 3.3; RHO = -.09$$

$$DEPOR = 2.71 + .46TBRATE + .21DEPOR_{t-1} + 1.67D8990 - 1.92D78$$
[76-94] (5.4) (14.8) (4.0) (2.7) (-2.2)
$$R^2 = .98; \bar{R}^2 = .97; Q(4-0) = 3.2$$

LENDR is the bank lending rate. It is a function of the treasury bill rate *(TBRATE)*. D8388 is a dummy for the period 1983-1988. Its sign is negative and statistically significant. This perhaps reflects increased control on interest rates by the government following increased international debt problem and high international rates in 1980's. This may have been driven by the desire for the government to borrow cheap locally.

The equation for the deposit rate is specified under the same assumptions. The final equation for the deposit rate relates the savings deposit rate to the treasury bill rate and two dummies, for 1989 and 1978. In 1989-90 the minimum saving rates was increased to 13.5 from 11.50 in the previous years. Perhaps the dummy for 1989-90 reflects the effect of this increase. The dummy for 1978 is negative and statistically significant, this could be reflecting the effect of an increase in treasury bill rate from about 1.4 to 6 percent in 1978, however, deposit rates were left unchanged. A dummy was also included in the equation for credit, it came out with a positive and statistically significant coefficient. This perhaps reflects the expansionary policy pursued by the government in these years. An interesting observation on the credit equation is the significance of the dummy *ELECT*. This dummy carries a value of 1 for election years and zero elsewhere. It came out with a positive and statistically significant coefficient suggesting that the government adopts expansionary policies in election years. This may be partly a reflection of financing of elections.

The other component of investment that is modeled is the change in capital stock (*CHSTK*). This is by nature a very volatile variable given that it depends on a wide range of

factors especially factors that affect actual supply and demand. The independent variables are a two year moving average of lagged change in capital stock and growth in real output; current and lagged one year. There are two dummies included for 1985 and 1989. These dummies perhaps reflect the effect stocks following drought. The following equation is accepted for *CHSTK* variable.

$$CHSTK = 187.79 + .89(CHSTK_{t-1} + CHSTK_{t-2})/2 + 1252.62\Delta Y - 1055.21\Delta Y_{t-1} + 76.31D85 + 105.86D89$$
[78-94] (0.4) (4.9) (1.9) (-1.8) (2.4) (2.2)
$$R^2 = .78; \bar{R}^2 = .64; RHO = -.56; Q(4-1) = .77; DW = 1.7$$

Gross Investment *(GROSINV)* in the model is a summation of the change in stock *(CHSTK)*, gross fixed capital formation in the private sector (I_P) and gross fixed capital formation in the public sector *(PUBINV)*. Public sector investment is assumed to be exogenously determined. Thus:

$$GROSINV = PUBINV + I_P + CHSTK$$

Capital stock in the model is calculated from gross investment using a perpetual inventory technique and a constant depreciation. Data on capital stock was only available up to 1992. For 1993 and 1994, a depreciation rate of 5 percent has been assumed. This level is consistent with the levels of depreciation in late 1980's and early 1990's which averaged about 5 percent The capital stock (end of year) is computed as:

$$K_t = K_{t-1} + GROSINV - \delta K_{t-1}$$

Where δ is the depreciation rate and *GROSINV* is gross investment as defined above

5.1.2 Domestic Prices

The measures of domestic prices that are included in the model are: the GDP deflator (*GDPDEF*), the Consumer Price Index *(CPI)* and the deflator for investment goods *(KDEF)*. Generally, the *GDPDEF* has a wide coverage including intermediate inputs and services whereas the *CPI* is based on a 'basket of goods' at retail prices. In modeling the price level and *GDPDEF* we have adopted a markup pricing mechanism but at the same time recognizing that an excessive increase in money supply would induce inflationary pressures. Thus our price variables are modeled as dependent on the ratio of money supply to real output, the price of imported goods in local currency and the wage rate or cost of labor input. The implicit GDP deflator *(GDPDEF)* is used in the model to generate nominal GDP from the real GDP series. The estimated coefficients have the right signs and are statistically significant. The estimation technique is Cochrane-Orcutt Iterative Technique (CORC).

The ratio of money supply to real GDP is included as a demand pull factor. This variable is used on the basis of the simple quantity theory of money which asserts that the price level is proportional to the stock of money. The quantity theory of money equation can be written as;

$$P = \frac{M}{Y}.v$$

where M is money stock, Y is real income and v is the income velocity of money. The coefficient for the variable $\frac{M}{Y}$ came out with the expected sign and is statistically significant. The price of imports and wage rate are included on the basis of the assumption that firms set prices as a markup on labor costs and cost of material inputs. If we assume that the wage per unit of labor is W and each unit of labor produces y units of output, then the cost per unit is $\frac{W}{y}$. Within the markup pricing mechanism, the cost of other material inputs have an impact on

the final price that the firm charges. If we assume that material requirements per unit of output is ρ and that ρ costs P_m, then the cost of material input per unit of output is ρP_m.Therefore firms set prices as a markup(πP) on labor costs and material input costs. The final price can be expressed as;

$$\Pr = (\frac{W}{Y} + \rho P_m)(1 + \pi P)$$

Where Pr is the final price that purchasers pay for the given commodity. As is expected, in a less competitive market the markup will include some level of monopoly profit. In our estimated equations, the price of imports serves as a proxy for the price imported inputs. The estimated equation is:

$$GDPDEF = .21 + .07PM + .68M2Y + 54.44w$$
[76-94] (4.9) (5.7) (3.3) (17.86)
$R^2 = .99; \bar{R}^2 = .99; DW = 1.5; RHO = .73$

The GDP deflator equation (reported) above and CPI equation (reported below) are estimated by the Cochrane-Orcutt technique. In estimating the econometric equation for the general price level, CPI, the utilization ratio (UTIL) variable was considered. As one would expect, the higher the utilization ratio, the lower the average cost per unit of output and therefore firms are expected to charge lower prices. As expected, the sign for this variable came out as negative. It should be noted that, the specification of the price variable in logs gave better results and was thus adopted.

$$\ln CPI = 2.49 + .14 \ln PM + .25 \ln M2Y_{t-1} + 1.08 \ln w - 1.07 \ln UTIL$$
[77-94] (8.8) (3.1) (3.8) (9.8) (-3.6)

$$R^2 = .99; \bar{R}^2 = .99; DW = 1.6; RHO = .89$$

The other domestic price that is estimated, is the price of investment goods (KDEF). The investment goods deflator is treated as a function of the GDP deflator *(GDPDEF)* and price of imports. The price of imports is relevant in this specification due to the high dependence on imported capital and intermediate inputs. Although the price of imports may impact on price of investment goods indirectly through the GDPDEF (see specification above), the results suggest that import price may have a direct impact on the price of investment goods. The equation below is adopted for the model. The investment goods deflator series is used for deflating nonwage incomes and credit to the private sector.

$$KDEF = -13.57 + .13PM + .67GDPDEF + .42KDEF_{t-1}$$
[76-94] (-2.1) (2.4) (3.3) (3.3)

$$R^2 = .99; \tilde{R}^2 = .99; DW = 2.1; F = 2208.16; Q(4\text{-}0) = 6.2$$

5.1.3 Employment And Wages

The level of employment is hypothesized as determined by the capital stock, growth in output, unit labor cost and other basic variables like technology. An increase in unit labor cost implies that the marginal cost facing a firm has increased, if the firm can not pass on the increased cost to consumers then firms would wish to produce less. In addition an increase in unit wage cost (ceteris paribus) means that labor is relatively expensive and thus firms will tend to substitute labor with capital in order to remain profitable. A fall in labor productivity per unit of labor may be the cause of high unit labor cost, however, in a competitive market system this may result in low entrepreneurial incomes as the increased costs can not be passed over to the final consumer. Faced with such circumstances, the survival of the firm will much

depend on how well substitution between labor and capital can take place or otherwise the firm may have to be scaled down operations thus reducing the demand for labor. If the firm can pass over the increased costs then prices may increase and prices increase employees may demand compensation, which may result in a price wage spiral.

Thus the expected sign for the coefficient of the unit labor cost variable is negative. The level of capital stock is included as a binding factor, in the sense that supply limitations are part of the problem. As one would expect, the coefficient for this variable is positive. A high growth in output may result in increased demand for labor, the expected sign for the growth variable is positive. The time (T) is included in the equation to take care of other factors that may affect the level of employment such as technological change.

The coefficient for the time trend came out with a positive sign and is statistically significant. The most probable explanation of this significance could the rapid expansion in public sector employment which can be seen from the table below. However, since early 1990's the government has been engaged in personnel retrenchment under SAP's. An alternative interpretation could be that there has been a move toward more labor intensive activities or falling labor productivity. As regards productivity, one government policy document concludes that.. *"The position regarding labor productivity in our industries reveals three factors, namely overcapitalization, excess capacity and insignificant growth in labor productivity"*, National Development Plan 1994-1996, page 208, Republic of Kenya, 1994.

Table 5.1: Trends in Employment: Public and Private Sector Employment

Modern Sector Employment('000's)							
	1976	1985	1989	1990	1991	1992	1993
Private	501.1	599.8	682.8	709	726.7	768.4	789.5
Public	356.4	574.6	685.6	700.6	715	693.7	685.4
Total	857.5	1174.4	1368.4	1409.6	1441.7	1462.1	1474.9
SHARE							
Private	58.44	51.07	49.90	50.30	50.41	52.55	53.53
Public	41.56	48.93	50.10	49.70	49.59	47.45	46.47

Data Source: Statistical Abstract, Various Issues, Republic of Kenya

Employment in this model only refers to employment within the formal sectors. Data for other categories of employment like self-employed, urban and rural informal sector employment as well as rural small scale employment is not consistent and is only available for discrete periods. For this reason, no attempt was made to estimate employment under these other categories. Our equation for employment in the modern sector is given as

$$\ln L = 4.7 + .05 \ln \Delta Y + .18 \ln K - .42 \ln w_{t-1} + .07T$$

[78-94] (7.9) (2.8) (2.6) (-3.7) (5.8)

$$R^2 = .99; \bar{R}^2 = .99; DW = 2.1; F = 823.4, RHO = .40;$$

In the model, there is also an equation that links wages to prices. Sometimes it is usually argued that the price-wage relationship may bring about a wage-price spiral, such that an increase in wages results in higher prices and higher prices to higher wages. A process usually referred to as a price-wage spiral.

The equation for labor cost of production is estimated in terms of the price level and the wage cost in the previous year. A time trend (T) is included to take care of increases in wages that may come through improved productivity or trade union movement. The variable,

T, came out with a positive sign but statistical insignificant, thus has been dropped from the final equation reported below.

$$\ln w = -1.05 + .67 \ln w_{t-1} - .29 \ln(CPI + CPI_{t-1})/2$$
[77-94] (-5.1) (10.2) (5.5)
$$R^2 = .99; \bar{R}^2 = .99; DW = 1.9; F = 3289.6; RHO = .06;$$

Both variables came out with the expected signs and the T- statistic is significant in both cases. The wage-price elasticity is less than unity (.29). The implication is that a one percent increase in price level is usually associated with a less than one percent increase in wage cost. The statistical significance of the estimated coefficient imply that increases in price level actual lead to increase in wage cost. The autoregressive coefficient for wage cost is however less than unity. This implies a long run convergence. Therefore, since both the wage-price elasticity and the auto- regressive coefficient for wage cost are less than unity, this implies that there is less likelihood of a wage-price spiral. Trade union activities as well as government wage guidelines that require workers be compensated for increases in cost of living, may explain the strong relationship between prices and wages. In the model, nominal wage income (wC) is defined as average wage rate *(w)* times number of people employed *(L)*.

5.1.4: Private Consumption

Our private consumption function is a simple Keynesian type aggregate consumption function relating consumption to incomes but also recognizing the importance of wealth. Consequently, consumption is a function of wage incomes, non wage incomes and wealth (represented by the stock of financial assets). Consumption is estimated in nominal terms and then the deflator for consumption expenditure *(CONDEF)* is used as a deflator to obtain real

consumption *(PRCON)*. The following equation is accepted for nominal consumption *(CONSP)* function.

$$CONSP = -1021.29 + .38\pi C + 1.37(wC + wC_{t-1})/2 + .95SA$$
[77-94] (-3.2) (4.2) (8.6) (3.1)
$R^2 = .99; \bar{R}^2 = .99; DW = 1.96;$

The above equation is estimated by the instrumental variable technique correcting for first order serial correlation. The estimated coefficients have the expected signs and are statistically significant. The estimated equation seems to support the view that consumption out of wages is high than consumption out nonwage incomes.

5.1.5: Exports of Goods and Services

In estimating the equation for exports of goods and services, we test the hypothesis that as production capacity goes up so are exports. Taylor (1993)[69] argues that in most developing countries, foreign sales fall as domestic demand rises so that exports decline as a function of capacity utilization. Jansen (1995) has tested this hypothesis for Thailand and found a positive relationship between production capacity and export volume growth. Our results suggest a similar positive relationship between growth in domestic output and export growth.

$$X = -1197.67 + 0.01P_X + .36Y$$
[77-94] (-1.9) (10.3) (3.6)
$R^2 = .98; \bar{R}^2 = .97; DW = 2.8; RHO = .88;$

[69]Taylor, L., (ed) *The Rocky Road to Reform. Adjustment, Income Distribution and Growth in Developing World* (Cambridge, MA: The MIT Press, 1993) cited in Jansen (1995)

Where PX is the price index of exports of goods and services in local currency terms and Y is domestic output The estimation technique is instrumental variable technique correcting for first order serial correlation

5.1.6: Import Equations

Usually the demand function for imports relate imports to the import price level and income in the form:

$$(MC/PM) = b_0 + b_1(PM/CPI) + b_2 Y + e$$

Where;
MC = Imports in current Kenya Shillings

PM = Price index of imports

CPI = Is the domestic Price Level

Y = Real GDP for Kenya and e is a random term

On the basis of the above specification, the equation below has been estimated.

$$M = -3928.87 - 345.02(P_M/CPI + P_M t_{-1}/CPI_{t-1})/2 + .75DOM$$
[76-94] (-6.2) (-2.4) (13.5)

$$R^2 = .97; \bar{R}^2 = .97; DW = 2.0; RHO = .94;$$

In the above equation, the income variable *(DOM)* excludes imports from GDP. Consequently, the relevant incomes are expenditures on domestically produced goods, that is, government expenditure, private investment and consumption and receipts from exports. The variables came out with the expected sign and are statistically significant. The price variable enters as a two year moving average of the price variable.

In the literature, discussion of trade issues between industrialized and developing countries usually focus on the distinction between primary products and manufactured goods. With representatives from developing countries arguing that exports of primary products puts

them in a weaker position due to declining terms of trade and instability in commodity prices. The other issue relates to the access of manufactured goods from developing countries to industrial country markets.

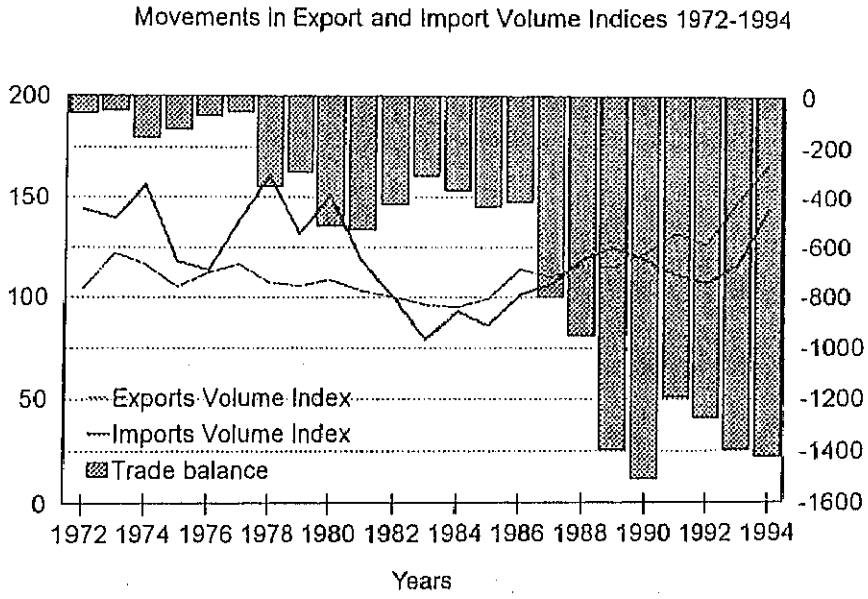
A close examination of data on Kenya suggest that the terms of trade fell over the period of study. Although the volume of exports have increased, when relative prices are taken in to account, Kenya's external trade position actually worsened. When discussing the trends in exports and imports, confusion may arise between volume and price changes. Thus it is better to discuss trends in volumes before introducing price changes. This is important because increases in volumes may be outweighed by a fall in terms of trade resulting in increasing deficits.

The chart 5.2 below shows the movements in exports and import volume indices, and balance of trade over the period 1972-1994. It can be seen that until 1982, there was a stagnation in export volumes. This may be explained in terms of an overvalued domestic currency and limited efforts at encouragement of exports. The government was still highly committed to the import substitution strategy of industrialization. In 1982, there was a devaluation of the local currency. There must have been a slower response in exports until after 1982. Thereafter, it can be seen that increases in export volumes exceed increases in import volumes except for the period around 1988 and 1989.

When prices are taken to into account, the trend in Kenya's trade balance is reversed. Despite improvements in export volumes, the performance in the trade sector has been dismal This reflects the effect of falling terms of trade. Consequently, the operating surplus of domestic producers against the rest of the world may not increase despite increases in volume of exports relative to volume of imports. The policy implication of this is that it may be

necessary to diverse exports and promote exports of manufactured goods. Perhaps a long term strategy goal of a developing country should also be to nurture and develop a capital goods industry, since a large share of investment activity goes to the importation of machinery. Most of innovation takes place within the capital goods industry which is necessary to increase the capacity of the domestic economy to produce goods and services.

Chart 5.2: Movements in Export and Import Volume Indices and Balance of Trade 1972-1994



Data Source: Republic of Kenya, Statistical Abstract and Economic Survey, various issues

5.1.7: Public Expenditure- Revenue Decisions and Private Investment

Although public expenditure and taxation (with the exception of indirect taxes variable which is modeled) are determined exogeneously in the model. From the discussion in chapter 3, government expenditure decisions may have an important impact on private investment. We have discussed the concept of 'crowding out' and 'complementarity between public

investment on infrastructure and private investment. The discussion is extended here within a macroeconomic framework.

Government in this analysis is defined to include all levels of government as well as state corporations which are financed through the government budget. It covers all the activities of the government including defense, government ministries, the judiciary system, local government e.t.c. To discuss government expenditure G we dis-aggregate it into: current expenditure and capital expenditure. The major components of current expenditure include; labor costs and expenditure on goods and services CEg, transfers (TRg), interest rate payments on domestic debt (INTgd) and interest rate payment on external debt (INTgx). On the other hand, capital expenditure mainly comprise investment expenditure (Ig). Therefore government expenditure (G) can be expressed in terms of its components as;

$$G = CEg + TR + INTgd + INTgx + Ig$$

Government revenue sources include: net indirect taxes (TAX), direct taxes (Td), transfers received from abroad (mainly grants Gr), and operating surplus of state corporations (osg). However, the operating surplus generated by the government has been insignificant. During privatization the government may raise some revenue through sale of state corporations, but such income can only be considered as transitory. Assuming that such revenue is insignificant we can write;

$$TAXR = TAX + Td + Gr$$

Whenever the government expenditure runs ahead of government revenue, there results a deficit. Such deficit can be financed through domestic and external borrowing or by obtaining external grants.

Within our framework of analysis, as indicated above, it is assumed that all incomes or expenditures (government, investment, consumption expenditure and exports) are earned by owners of property who in turn, out of these incomes pay wages to employees and taxes to the government. In turn the government uses tax revenue and borrowing or external grants for expenditure on essential services. Since generally speaking all incomes are earned by owners of property, government taxation essentially reduces these incomes and would thus be a disincentive. Again looking at wages as a major component of consumption expenditure, excessive taxation of wage incomes may be affect consumption adversely.

Government purchases of goods and services from the private sector serves as a demand component and may be useful in stimulating or directing demand towards 'desired commodities' or 'challenging' private producers to upgrade their activities (Porter, 1990).

The other component of government expenditure that deserves mention is the labor costs of providing services. In early 1980's Kenya was already facing problems with the composition of its expenditure. Over the period 1974 to 1984, the central government employment grew by 7.4 per cent against 2.8 per cent in the private sector. By mid 1980's salaries were taking more than 60 per cent of some ministry's recurrent expenditure. As one government policy paper laments; *"With salaries absorbing much of the expenditure there is not adequate provision for complementary resources, such as transport, typewriters, even paper and pencils, that are required to make these officers productive..... Eventually many services may cease to be offered at all, while officers continue to draw salaries"* (Republic of Kenya, Sessional Paper No. 1 of 1986, 1986, page 32). This just illustrates the possible problems that might arise if a government decides to tackle the problem of unemployment by simply increasing its workforce. In this case the government should avoid

taxing the private sector to pay salaries for employees who do not improve the production capacity of the economy or provide essential services. Thus from the point of view of the public sectors contribution to the growth of private sector and the capacity of the economy to produce goods and services, then a *small and efficient government* providing infrastructure for business and public goods in general (such as defense and judicial services) would be desirable. The term small government in this context should be viewed in terms of what the government takes away from the private sector against what it provides.

In recent years, interest payments and loan repayments have become a serious problem in the provision of public services by the government. Interest payments[70] take more than 30 per cent of current expenditure. Loan repayments also take a large share of capital expenditure leaving little resources for investment on economic services. The table below shows the composition of public expenditure for selected years.

[70]In the table above, the high interest payments reflect the impact of high interest rates on treasury bills after liberalization. This just simply underscores the importance of achieving and maintaining stability before and after interest rates are liberalized.

Table 5.2: The Structure of Government Expenditure for Selected Years

	1989/90	1992/93	1993/94
A. Current Expenditure			
1. Labor Costs	575610	800702	1064382
2. Other goods and Service	618457	808515	1061134
Of which military	241220	242171	304705
3. Interest on Public Debt	500220	1392660	2737981
4. Current transfers	469043	874509	1050417
Total	2163330	3876386	5913914
Shares in total Current Expenditure			
1. Labor Costs	26.61	20.66	18.00
2. Other goods and Service	28.59	20.86	17.94
of which military	11.15	6.25	5.15
3. Interest on Public Debt	23.12	35.93	46.30
4. Current transfers	21.68	22.56	17.76
B. Capital Expenditure			
1. Capital Formation	490592	410897	465300
2. Loan Repayments	453341	1672446	2461358
3. Others	109005	123032	166961
TOTAL	1052938	2206375	3093619
Shares in Capital Expenditure			
1. Capital Formation	46.59	18.62	15.04
2. Loan Repayments	43.05	75.80	79.56
3. Others	10.35	5.58	5.40

Data Source: Economic Survey, 1994 and 1996, Republic of Kenya

When the government borrows from it's citizens it places a burden on future generations to pay the interest rate on the national debt. It is sometimes argued that national debt is not a real burden, since those who receive interest payments and pay taxes are citizens of the same country. Proponents of crowding out insist that the government compete with the private sector for funds. Consequently, given the available funds, more to the state means less to the private sector . There is also a social aspect of the national debt; only the rich buy government securities, and thus receive interest payments while taxes fall on everybody, that is including the poor people.

The discussion above suggests that different components of government expenditure and their financing may have diverse effects on private investment. In the macroeconomic

model developed we distinguish two types of government expenditure: government consumption expenditure and public investment. Further dis-aggregation would require a much larger and complex macroeconomic model than presented above.

As regards government expenditure-revenue variables, indirect taxes are modeled in the model. Indirect taxes are treated as a function of total expenditure (GDP) and a trend (T) variable that represents other measures that the government may try to implement to increase revenue. In recent years, the structure and administration of tax system has undergone various changes under the structural adjustment reforms. Among the reforms has been the replacement of sales tax by value added tax, abolition of export duty, administrative changes and extensive computerization. The endogenous variable is real Indirect tax revenue (TAX) and nominal indirect tax revenue (TAXC) is obtained by deflating the real tax revenue.

$$.TAX = -615.19 + .42GDPT - 43.57T$$
[76-94] (-3.9) (8.9) (-4.5)

$$R^2 = .96; \bar{R}^2 = .95; RHO = .47;$$

$$.DEFTAX = -14.23 + 1.13GDPDEF - 23.51D92$$
[77-94] (4.6) (5.8) (-4.5)

$$R^2 = .99; \bar{R}^2 = .99; RHO = .72;$$

5.2.0: Computer Simulations of the Estimated Macroeconomic Model

The estimated behavioral and definitional or institutional equations are developed in to a computer simulation model[71]. The first task in the computer simulation process is to asses the validity of the model before using it for policy simulations. Specifically we are concerned with the problem of how well the estimated model explains the Kenyan macroeconomy or in other words, the *explanatory effectiveness* of the model. To validate our model we use two techniques. The first is graphical. It basically involves comparing the simulated output against the actual data. The second technique of ascertaining the 'goodness of fit' is statistical based on the *Theil Inequality Coefficient.*

The charts below are the graphical presentation of model results in comparison to actual data for selected variables. A casual observation of the results lead us to a tentative conclusion that our simulation model fits reasonably well to actual observed data.

As for the statistical tests of goodness of fit we can make use of Root Mean Square Errors (RMSE) of forecasting and the *Theil Inequality Coefficient* commonly referred to Theil U Statistic. The RMSE is affected by the units of measurement and thus it is not easy to work with especially when comparing different models estimated in different units. The Theil U which is a unit free measurement has advantage over RMSE. It is the ratio of RMSE to the RMSE of the 'simple' forecast of no change in the dependent variable over time.

In statistical test on the accuracy of the model on the basis of the Theil U, uses historical data for the period 1980-1994 for 1 to 10 steps of forecast[72]. The accuracy statistics are reported below for each variable at each step of forecast. The results obtained are

[71]The econometric analysis together with the simulations are carried out in Rats for Windows Ver. 4.31.
[72]This historical period has been chosen rather arbitrarily. Other periods have been tried producing close results. For example we have tried 1982-92, 1986-1994 with different forecast steps.

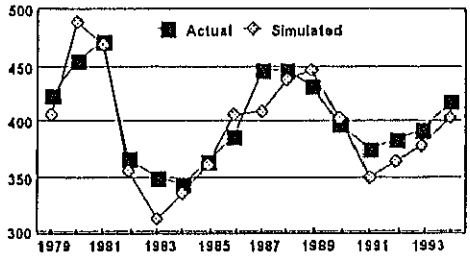
encouraging. For most variables, the Theil U is 'significantly' less than 1 which allows for further policy analysis. On the basis of our validation criterion, the model appears to be acceptable. Generally speaking, the model performs better for shorter period forecasts as evident in the falling Theil U Statistic as the number of observations reduce in many cases.

Another validation procedure would involve using the model for out of sample forecasts and comparing the forecast results with the actual data. Due to lack of consistent out of sample data on the main exogenous variables, post sample forecasts are not carried out.

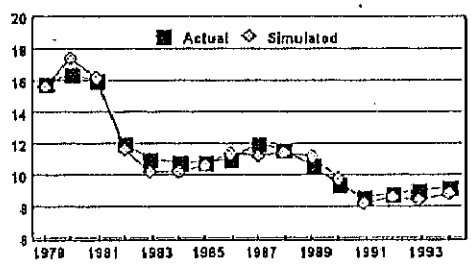
Chart 5.3: A Graphical Presentation of the Explanatory Effectiveness of Estimated Model

Explanatory Effectiveness of the Estimated Model: Historical Dynamic Simulations for Selected Variables

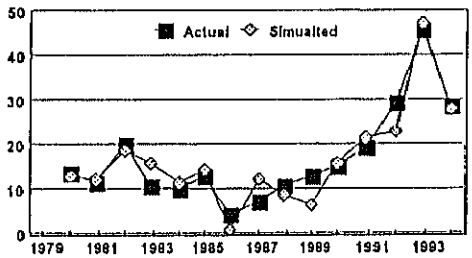
Real Private Investment



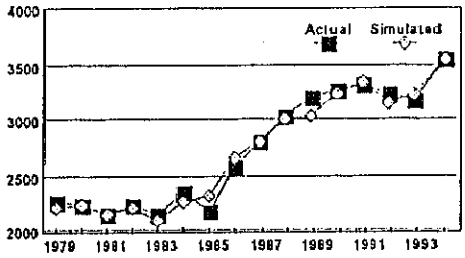
Investment Rate



Annual Inflation Rate

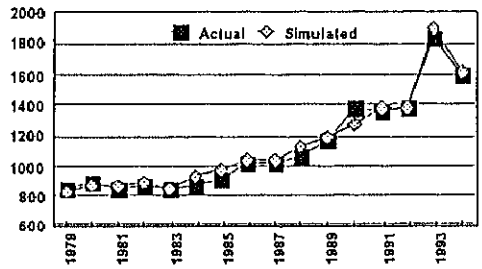


Real Private Investment

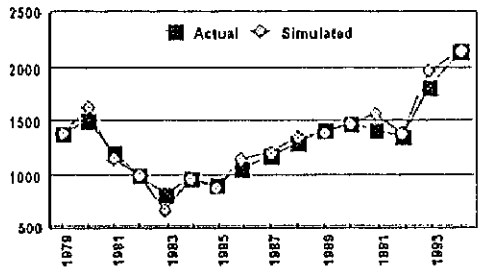


Explanatory Effectiveness of the Estimated Model: Historical Dynamic Simulations for Selected Variables

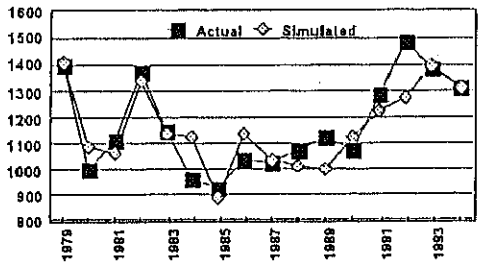
Real Exports



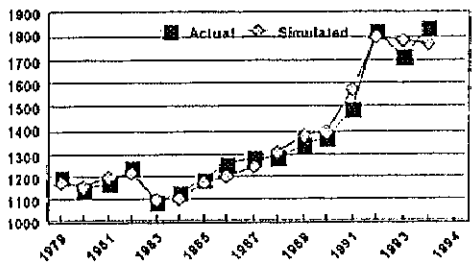
Real Imports



Real nonwage Incomes

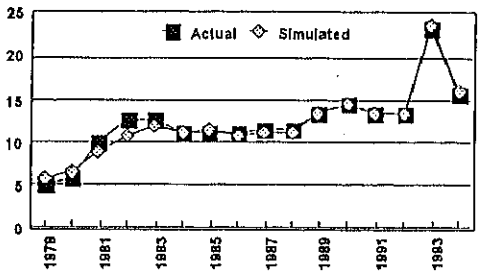


Financial Savings

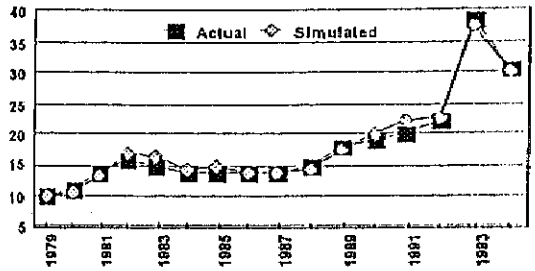


Explanatory Effectiveness of the Estimated Model: Historical Dynamic Simulations for Selected Variables

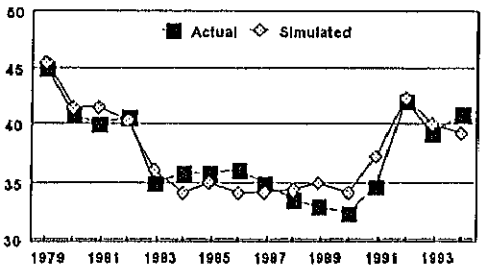
Deposit Rate



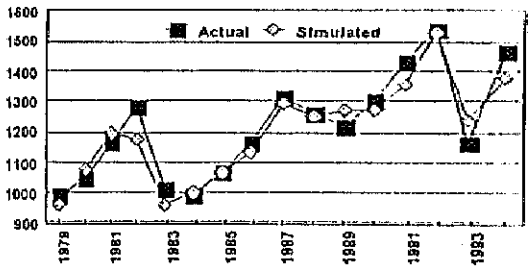
Lending Rate



Financial Saving Rate



Real Total Credit



Forecast Performance Statistics for the Estimated Equations (Macroeconometric Model)

Forecast Performance Statistics

Forecast Statistics for Series I_P

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.92261190	17.69621674	21.98894991	0.5348945	16
2	-0.14104582	19.55330196	24.21215327	0.4240950	15
3	4.64118161	16.67056525	24.29624519	0.3560110	14
4	6.57341586	16.34139506	21.43241820	0.2624401	13
5	9.16078980	20.78814788	23.59263401	0.2888315	12
6	9.51480656	19.89466669	24.32117988	0.3389261	11
7	11.25356290	19.57571572	27.36531323	0.4810373	10
8	12.92221984	22.96296827	26.88565631	0.5466086	9
9	15.77054965	28.14846205	30.05464778	0.6505579	8
10	9.81513705	24.18512178	25.56271603	0.4364100	7

Forecast Statistics for Series CHSTK

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	9.63967440	44.27642094	54.12501172	0.4791812	16
2	-8.77167984	63.35704580	76.69939676	0.7245876	15
3	12.11608749	67.54693616	83.99415433	0.7546159	14
4	-9.75525174	70.18808789	83.44258820	0.7898752	13
5	-1.20734043	71.39552701	84.94366580	0.8012453	12
6	-8.12150750	70.71105862	85.67021240	0.6124668	11
7	4.14463322	61.00465700	74.45186337	0.6452401	10
8	-8.25237129	54.98921878	68.51568673	0.6203392	9
9	1.64034119	49.85449582	63.49092864	0.5744759	8
10	-3.38873669	49.69506188	64.49062605	0.5954841	7

Forecast Statistics for Series LENDR

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	-0.071248103	0.657981602	0.822635831	0.1748347	16
2	-0.121188566	0.849661059	0.988687276	0.1690529	15
3	-0.203597450	0.877632825	0.993662127	0.1447044	14
4	-0.276344682	0.877943186	0.991078811	0.1286203	13
5	-0.230022148	0.862332372	0.989689277	0.1128647	12
6	-0.125892723	0.813611641	0.945165445	0.0972804	11
7	-0.086394637	0.842583640	0.977709871	0.0950873	10
8	-0.004392393	0.844951873	0.993724125	0.0916879	9
9	-0.044297632	0.911727531	1.048612284	0.0904832	8
10	-0.088618366	1.004191976	1.116630368	0.0902833	7

Forecast Statistics for Series CONSP

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	2.3986996	84.0670487	104.7007277	0.1323910	16
2	-13.2200193	95.7788006	130.1558440	0.0869127	15
3	-1.2364181	119.7291219	151.1099751	0.0701955	14
4	5.0493347	138.9630513	175.1034051	0.0647086	13
5	13.8902976	145.3823452	182.1639583	0.0563253	12
6	18.9461573	146.5427425	178.2724939	0.0469610	11
7	18.4696980	141.0477999	178.8105294	0.0413554	10
8	48.7069917	116.1573149	164.3295189	0.0338457	9
9	68.9035789	98.6501234	153.6411873	0.0285758	8
10	73.1931884	123.1862605	167.6657174	0.0285634	7

Forecast Performance Statistics

Forecast Statistics for Series TAX

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	1.26589880	29.99277579	34.65535588	0.6916322	16
2	-6.15021047	42.18906218	48.86628747	0.5934927	15
3	-5.08485383	49.24566541	58.42651737	0.5398585	14
4	-5.38689547	56.44723949	64.07602821	0.4831642	13
5	5.16993148	57.46652364	63.58814732	0.4114445	12
6	13.60347275	56.88789810	61.97125813	0.3683286	11
7	22.15148522	50.58612992	56.01328668	0.3047153	10
8	33.43074338	41.64581861	48.51459732	0.2431061	9
9	40.67621431	40.67621431	45.33186310	0.2109509	8
10	38.99297709	41.69627288	48.26028665	0.2214905	7

Forecast Statistics for Series GDPDEF

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.219602258	1.806527630	2.320153791	0.0915241	16
2	0.315067820	1.828566655	2.143730006	0.0450112	15
3	0.476177168	1.936018902	2.102230311	0.0327016	14
4	0.627952606	2.091480331	2.407345478	0.0307551	13
5	0.716529416	1.979204806	2.256322065	0.0246963	12
6	0.710772483	2.041525479	2.274827699	0.0218342	11
7	0.517135414	1.977001965	2.221493359	0.0189738	10
8	0.288564742	1.789838474	2.050563260	0.0157444	9
9	0.109040236	1.763987999	2.064154657	0.0142490	8
10	0.159309959	1.929442433	2.172467418	0.0135155	7

Forecast Statistics for Series KDEF

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.541508654	4.660998053	5.869887205	0.1666874	16
2	0.702431348	5.448045690	6.622479339	0.1033880	15
3	1.032365320	5.470626034	7.176618421	0.0868297	14
4	1.675056280	5.937377411	7.388368747	0.0718558	13
5	2.345149898	5.679000561	7.330578024	0.0590679	12
6	2.175750419	5.730739868	7.347302111	0.0517666	11
7	1.282422249	5.307863373	6.911744742	0.0433603	10
8	1.461604451	5.849275088	7.258511411	0.0406352	9
9	0.456037748	5.335438708	6.807753968	0.0341350	8
10	-0.042419483	5.435747920	7.039498987	0.0319946	7

Forecast Statistics for Series SA

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	-1.58960708	34.17203203	38.89466768	0.3445749	16
2	-2.29499956	35.04204756	39.67554798	0.2560772	15
3	-2.26059091	39.34105984	45.55702579	0.2194345	14
4	0.60819471	43.09600285	48.29035614	0.1938788	13
5	-1.40447734	42.30706647	47.89842034	0.1739203	12
6	0.51726936	45.20985496	50.99068039	0.1657130	11
7	-0.52241864	46.18040522	50.86929512	0.1485864	10
8	-2.59488822	48.93161950	52.84795477	0.1370305	9
9	-9.95940698	47.78201814	52.44048825	0.1225040	8
10	-17.54236215	48.30470459	53.48761807	0.1188524	7

Forecast Performance Statistics

Forecast Statistics for Series X

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.34075673	41.66338798	53.25704582	0.3643579	16
2	-6.01439866	38.37655576	52.66695139	0.2943940	15
3	-8.39091410	33.87375744	51.57969741	0.2395704	14
4	-11.46653848	36.25636251	51.61413375	0.1836072	13
5	-7.49384679	37.33200072	54.97642021	0.1573648	12
6	-10.89730063	42.47585612	57.94156369	0.1442978	11
7	-8.12152850	40.67055790	53.08174782	0.1197204	10
8	-5.64009451	39.41662559	54.31289642	0.1105416	9
9	-5.78680119	41.41473883	51.84807612	0.0950424	8
10	-6.94445098	39.90314694	46.37539316	0.0785494	7

Forecast Statistics for Series CRE

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	4.51598911	47.99967224	56.08556737	0.3477943	16
2	3.13665716	44.30701798	51.27391980	0.2860413	15
3	8.61316327	42.21403187	50.66229439	0.2690697	14
4	14.74572901	40.71876047	50.27129676	0.2809200	13
5	10.42370426	38.57621799	47.89390097	0.2751055	12
6	8.89788488	37.44817247	48.71809442	0.2248520	11
7	13.00958844	36.94691679	48.75518131	0.1939468	10
8	14.39571000	42.47914382	51.56719277	0.1798685	9
9	12.70603071	45.47719638	55.61322351	0.1906304	8
10	9.67448113	49.03349660	59.18524330	0.2105952	7

Forecast Statistics for Series M

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	16.05823416	55.97860455	72.61941658	0.3439664	16
2	-3.04584797	59.25122645	69.02481542	0.2176496	15
3	15.14488414	67.12134329	80.45082525	0.2064110	14
4	-6.91148937	60.28567075	83.52124325	0.1875259	13
5	-7.16704599	65.85566808	80.60688585	0.1577383	12
6	-29.68484909	62.04286561	76.91988270	0.1426115	11
7	-40.68658309	54.35261618	72.49613014	0.1239032	10
8	-48.83830126	60.56368280	82.05123760	0.1342727	9
9	-43.11632343	50.88015714	75.88244276	0.1214383	8
10	-45.06228402	59.95023976	79.52719815	0.1268260	7

Forecast Statistics for Series CPI

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.099018893	2.594792720	3.713985315	0.0951183	16
2	0.493621820	3.787184247	4.980145374	0.0700188	15
3	1.224429461	4.847970078	6.409524430	0.0700976	14
4	0.818769491	5.280867314	6.632298569	0.0621710	13
5	0.623137039	6.317058938	7.835225671	0.0653473	12
6	0.770684307	6.741657082	8.629937022	0.0652296	11
7	0.395477031	6.662104887	8.427073194	0.0583206	10
8	-0.069816642	5.871911663	6.727877097	0.0428835	9
9	0.032107535	5.710913779	6.822082806	0.0398870	8
10	0.856871209	5.090991820	5.902687344	0.0313500	7

Forecast Performance Statistics

Forecast Statistics for Series DEPOR

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.066865728	0.440944038	0.612511000	0.1786278	16
2	0.150361763	0.464106311	0.656302703	0.1812514	15
3	0.208000769	0.449411140	0.653563870	0.1598558	14
4	0.128988970	0.384056734	0.578727974	0.1270375	13
5	-0.005866744	0.269817978	0.326836070	0.0656301	12
6	-0.054960907	0.245911500	0.301007573	0.0588627	11
7	-0.055806826	0.265915971	0.315405633	0.0579863	10
8	0.008908046	0.224551693	0.255494961	0.0435116	9
9	-0.008665620	0.233931804	0.265787581	0.0407148	8
10	-0.071981493	0.205272036	0.231859899	0.0331305	7

Forecast Statistics for Series DEFTAX

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.876437872	5.079551283	5.391102039	0.1924112	16
2	0.996822815	6.188078520	7.841121815	0.1705774	15
3	1.409664823	7.947577569	9.675522327	0.1759628	14
4	1.456688452	8.108035683	10.508536293	0.1523629	13
5	0.751155885	8.074341321	10.328447347	0.1268221	12
6	-0.475690945	7.058785893	8.975407503	0.0978463	11
7	-2.441636033	5.365629598	6.123920266	0.0603037	10
8	-3.680768066	4.509738156	5.248972497	0.0465496	9
9	-4.359566451	4.399974173	5.295521685	0.0424734	8
10	-4.442835408	4.550769824	5.366257558	0.0387865	7

Forecast Statistics for Series GDP

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	9.6051543	58.7690280	74.2915401	0.4498069	16
2	-3.3188411	84.8473449	98.7647106	0.3100062	15
3	9.7662253	113.4569506	130.9768844	0.2801859	14
4	11.3967261	134.6377038	150.9775764	0.2436019	13
5	30.1517551	144.1020627	161.7739569	0.2077259	12
6	41.2677212	145.1931667	162.2768396	0.1721944	11
7	63.5381327	123.6436978	150.6120667	0.1355939	10
8	85.1318934	106.6612750	135.1566048	0.1059610	9
9	100.8253186	103.5186516	120.3205975	0.0842668	8
10	99.0226707	116.0581164	122.3868736	0.0785635	7

Forecast Statistics for Series π

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.53382292	61.99096859	75.59648639	0.4335519	16
2	-5.57775838	63.90858185	76.21824467	0.3527195	15
3	9.65224900	71.26019931	83.52922265	0.4194551	14
4	7.00716439	78.07646429	96.45684175	0.4254616	13
5	12.64470968	79.64831776	103.86340127	0.4144093	12
6	16.36952535	81.60890671	106.78281032	0.3818299	11
7	36.67757790	76.68590521	105.12403577	0.3605760	10
8	37.59206001	73.59823205	101.87351931	0.3405065	9
9	52.08114449	68.36564421	94.35778172	0.3515728	8
10	57.02860579	74.49355240	99.70106656	0.4782998	7

Forecast Performance Statistics

Forecast Statistics for Series PRCON

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	6.83003919	52.51164195	62.13099438	0.3337569	16
2	0.21269562	52.44353394	68.79563038	0.2609091	15
3	7.71880827	67.31584752	82.87626172	0.2217572	14
4	9.77979676	76.28990214	95.20713625	0.1973365	13
5	12.37253050	79.57582000	100.51724969	0.1708555	12
6	9.78929556	80.12971355	99.95928168	0.1427307	11
7	3.67471880	75.03066861	97.77136818	0.1217401	10
8	22.47888180	58.29828954	82.73093145	0.0909827	9
9	35.28947325	46.70071741	75.72444524	0.0749289	8
10	39.45568154	56.94459860	81.30288635	0.0780975	7

r Forecast Statistics for Series WRATE

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.001046218	0.027075731	0.037678858	0.1070120	16
2	-0.003013575	0.031984514	0.038782586	0.0639216	15
3	-0.005003538	0.037402611	0.043856376	0.0536594	14
4	-0.008360250	0.039280230	0.044868064	0.0446857	13
5	-0.011185685	0.039179611	0.042818537	0.0360924	12
6	-0.008197335	0.040468905	0.043359707	0.0315569	11
7	-0.005107278	0.037739874	0.041179696	0.0265007	10
8	0.001531456	0.030720199	0.032898328	0.0189020	9
9	0.004858619	0.030931983	0.034569058	0.0178333	8
10	0.009524547	0.029858757	0.034272239	0.0160401	7

Forecast Statistics for Series INVES

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.010598810	0.442179160	0.591448212	0.3778293	16
2	0.008398358	0.507266577	0.654961439	0.3002053	15
3	0.107463352	0.438973839	0.619947379	0.2225879	14
4	0.156964020	0.394788183	0.493099126	0.1356857	13
5	0.194998795	0.339458249	0.480154196	0.1215047	12
6	0.176597757	0.426349336	0.490239916	0.1209130	11
7	0.171583743	0.466264070	0.571080654	0.1376105	10
8	0.179594858	0.544706327	0.591505759	0.1351421	9
9	0.233878134	0.679499041	0.715181285	0.1497627	8
10	0.077407960	0.572162804	0.638405307	0.1136139	7

Forecast Statistics for Series CAPST

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	1.3148318	46.0575902	57.4999764	0.1787501	16
2	-14.0459629	55.0859231	69.6204457	0.1118120	15
3	3.0606645	73.3853906	83.1814957	0.0908768	14
4	3.3210635	74.7893330	90.1904168	0.0753902	13
5	16.5515010	96.7327466	110.8858244	0.0764840	12
6	25.3965773	84.6765980	107.8804377	0.0635528	11
7	50.4573246	79.5818025	110.7706447	0.0567978	10
8	59.8613694	81.9962325	115.3320480	0.0521513	9
9	65.9415075	72.2784619	96.1102582	0.0386305	8
10	57.0580984	68.4170752	105.5425532	0.0379337	7

Forecast Performance Statistics

Forecast Statistics for Series FSAVE

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	-0.113412880	0.957335335	1.073756453	0.3792102	16
2	-0.052555269	1.108672747	1.247021376	0.3161495	15
3	-0.154322370	1.300882584	1.509107064	0.3102700	14
4	-0.065937342	1.460068239	1.722091396	0.3045617	13
5	-0.189192229	1.599104956	1.788209923	0.2906994	12
6	-0.141292768	1.699938585	1.866901961	0.3019456	11
7	-0.319776475	1.611084897	1.804098298	0.2798990	10
8	-0.473973117	1.582533322	1.715073514	0.2420245	9
9	-0.757969427	1.378390331	1.547381605	0.1948182	8
10	-0.955532573	1.373538638	1.514218365	0.1881698	7

Forecast Statistics for Series PRCRE

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	4.51598911	47.99967224	56.08556737	0.7115497	16
2	3.13665716	44.30701798	51.27391980	0.5421957	15
3	8.61316327	42.21403187	50.66229439	0.5383779	14
4	14.74572901	40.71876047	50.27129676	0.4392611	13
5	10.42370426	38.57621799	47.89390097	0.3694703	12
6	8.89788488	37.44817247	48.71809442	0.3536581	11
7	13.00958844	36.94691679	48.75518131	0.3435002	10
8	14.39571000	42.47914382	51.56719277	0.3317895	9
9	12.70603071	45.47719638	55.61322351	0.3605974	8
10	9.67448113	49.03349660	59.18524330	0.4139415	7

Forecast Statistics for Series EMP

Step	Mean Error	Mean Abs Error	RMS Error	Theil U	N.Obs
1	0.61052509	11.54049687	13.39703315	0.3341951	16
2	3.12529850	13.10952811	16.24211653	0.2122343	15
3	-0.16075142	13.90423285	16.18302545	0.1410865	14
4	2.75269265	15.60698945	19.18008665	0.1236806	13
5	3.81406619	15.27560178	18.30558173	0.0927658	12
6	6.07978862	17.35218352	20.20120858	0.0845099	11
7	6.81281255	17.50651112	19.86769677	0.0703460	10
8	5.90532942	16.88505185	19.35402581	0.0599887	9
9	3.53102721	15.31916617	18.27375252	0.0504291	8
10	0.44059980	14.22675886	17.87212665	0.0445210	7

5.2.1: Policy Simulations

Our policy simulations goal have two dimensions. One is in the form of hypothesis tests and the other is to estimate the effects changes in decision variables on the economic system especially private investment and related macroeconomic variables. The hypothesis relate to 'crowding out' effects of government borrowing from the banking system and complementary effects of government investment. The other question relates to the effects of changes in interest rates on private investment.

Our first computer simulation experiment involves measuring the effects of a 'shock' on the economic system. This is important because it may give some information as to the stability of the system, that is, whether it returns to equilibrium after a shock. To test the impact of a 'shock' on the system we ask the question; what would have happened on the economic system if the government increased its borrowing from the banking system by K£ 100 million in 1979 all other things being constant?. Then we ask the same question but from a different angle, what would have happened on the economic system if the government would have increased its investment by K£ 100 million in the same year. We then combine the two simulations to see the net impact. That is increase borrowing by K£ 100 million and increase public investment by the same amount in 1979. The results are shown below.

The other simulation experiments involves testing the effects of continuous increases in government borrowing and public investment separately and both over the period 1990-1994. These simulations useful in evaluating the 'crowding out' and 'complementarity' hypothesis. The final simulation experiment involves testing the effects of an increase in government treasury bill rate on private investment and related macroeconomic variables. This

last simulation is of importance since the lending rate and savings deposit rate are closely related to the treasury bill rate, yet they have important effect on credit.

5.2.1.1: Does Government Crowd Out Private Investment?

To asses the impact of 'financial crowding out'. We run the model with and without the assumed change in the exogenous variable (government borrowing from the banking system) to compute the two sets of forecasts and then subtract them to obtain the multiplier effects. This experiment is executed by increasing government borrowing by K£ 100 million in 1979 and see the effect on the economy in 1979 and over an interim period after the assumed change. Since we are assuming crowding out, these statement is an equivalent of the question on the effect of an reduction in credit to the private sector by K£ 100 million in 1979.

Simulation 1: An increase of K£ 100 million in government borrowing

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1979	-2.85	-0.96	-3.24	-32.77	-1.27	-10.87	-28.55
1980	-0.29	-2.19	-0.63	-6.34	-1.51	-2.10	-18.49
1981	-3.63	-0.40	-1.88	-19.06	-0.98	-6.33	-11.43
1982	-0.98	-1.78	-0.11	-1.14	-0.78	-0.38	-6.64
1983	-1.57	-0.75	-0.54	-5.43	-0.25	-1.80	-3.27
1984	-1.13	-1.46	-0.11	-1.06	-0.25	-0.35	-0.94
1985	-1.04	-1.05	0.05	0.50	-0.02	0.16	0.42
1986	-1.43	-1.06	-0.08	-0.78	-0.01	-0.26	1.17
1987	-1.04	-1.05	0.13	1.28	0.02	0.42	1.54
1988	-1.26	-0.83	0.02	0.22	0.06	0.07	1.74
1989	-0.98	-0.84	0.08	0.84	0.04	0.28	1.73
1990	-0.91	-0.69	0.07	0.72	0.06	0.24	1.62
1991	-0.81	-0.65	0.05	0.54	0.05	0.18	1.48
1992	-0.59	-0.58	0.08	0.77	0.05	0.26	1.35
1993	-0.53	-0.49	0.06	0.57	0.05	0.19	1.23
1994	-0.49	-0.45	0.06	0.56	0.04	0.19	1.12

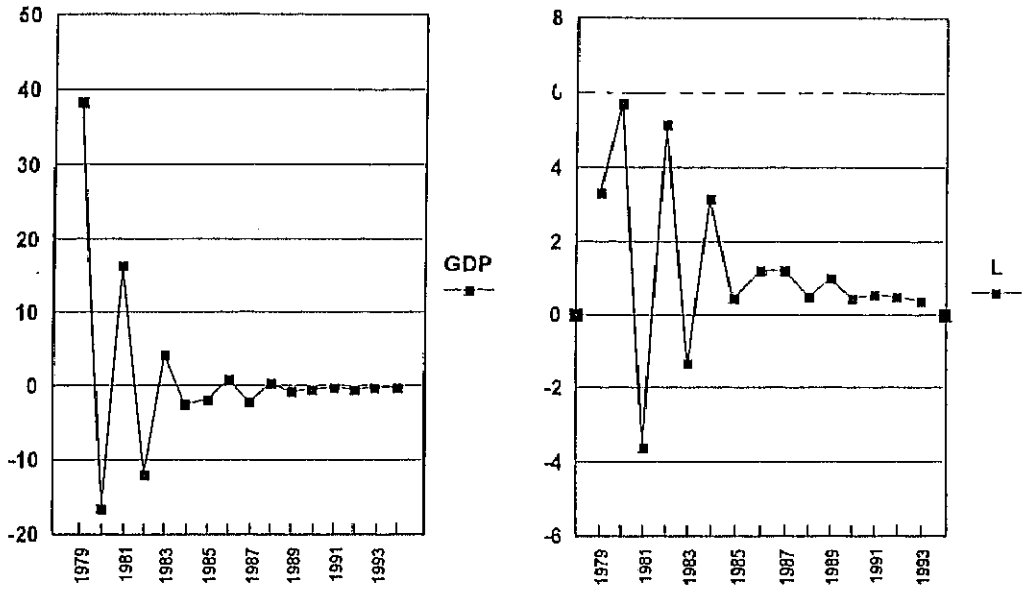
Simulation 1a: A Sustained increase of K£ 100 million in government borrowing: 1990-1994

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1990	-1.95	-0.84	-2.85	-28.84	-1.12	-9.57	-28.51
1991	-2.38	-2.96	-3.96	-40.05	-2.67	-13.29	-47.03
1992	-5.35	-3.82	-5.40	-54.65	-3.66	-18.13	-58.76
1993	-7.01	-5.35	-5.92	-59.98	-4.43	-19.90	-65.88
1994	-9.02	-6.45	-6.42	-65.05	-4.84	-21.58	-69.81

The estimated model identifies different direct and indirect effects of crowding out on the economy. Crowding out has a direct negative impact on private investment through the effect on credit availability to the private sector. There are also indirect effects on investment coming through the demand side of the economy. Other variables in the model that are affected include the external sector, that is imports and exports, financial savings, nonwage incomes and employment. The results suggest financial crowding out has adverse effects on the economy in general.

The results from our simulation experiment show the interim multiplier effects of a change in an exogenous variable (not sustained) on the endogenous variables (See simulation results: 1 and 2). The results suggests that system oscillates after an external shock before it converges to its long run values. Chart 5.4 shows plots for change in output (GDP) and employment (L) from simulation 2. The oscillatory trend can be observed. The trend is different for each variable. For example, it appears that output variable oscillates much faster than the investment variable. Generally however, our results suggest that the effect of increased financial crowding out or reduced credit to the private sector is adverse on the economy

Chart 5.4: Impact of a 'shock' on the system



.The table below shows the multiplier effects of an increase in government investment in 1979 (not sustained). The oscillatory trend as a result of a 'shock' (on time increase in government investment) is represented in Chart 5.4 above. The simulation results suggest that there is complementarity between public investment and private investment.

Simulation 2: An increase of K£ 100 million in government Investment

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1979	10.12	3.37	11.48	116.26	4.50	38.58	1.27
1980	-4.69	5.77	-4.90	-49.60	2.58	-16.46	1.38
1981	12.14	-3.60	4.95	50.12	0.02	16.63	-1.24
1982	-4.02	5.17	-3.54	-35.90	0.55	-11.91	-2.62
1983	2.93	-1.29	1.32	13.32	-0.87	4.42	-3.45
1984	0.41	3.21	-0.69	-6.96	0.25	-2.31	-4.03
1985	0.85	0.49	-0.56	-5.64	-0.49	-1.87	-3.68
1986	2.35	1.23	0.31	3.17	-0.10	1.05	-3.67
1987	0.24	1.23	-0.65	-6.55	-0.13	-2.17	-3.17
1988	1.82	0.52	0.13	1.28	-0.20	0.42	-2.85
1989	0.67	1.00	-0.24	-2.40	-0.04	-0.80	-2.43
1990	0.87	0.49	-0.11	-1.16	-0.14	-0.38	-2.04
1991	0.80	0.61	-0.04	-0.38	-0.06	-0.13	-1.73
1992	0.41	0.51	-0.13	-1.36	-0.07	-0.45	-1.46
1993	0.52	0.39	-0.04	-0.37	-0.07	-0.12	-1.27
1994	0.37	0.40	-0.07	-0.72	-0.04	-0.24	-1.09

Simulation 2a: A Sustained increase of K£ 100 million in government Investment: 1990-1994

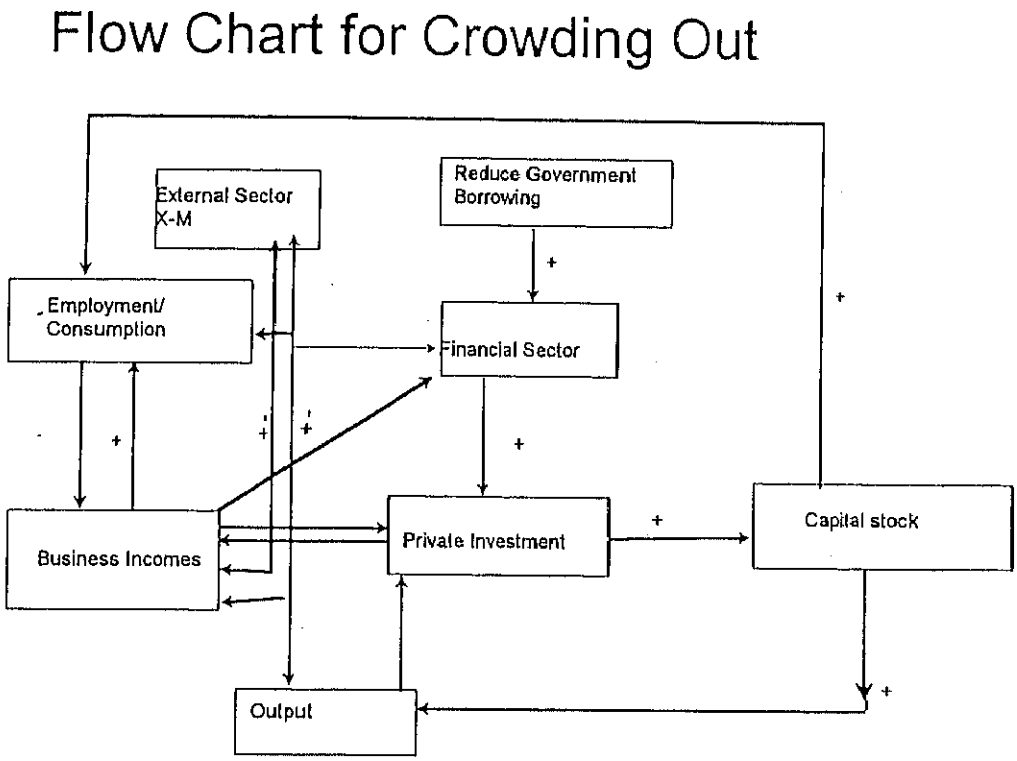
Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1990	6.92	2.95	10.10	102.30	3.96	33.94	1.12
1991	4.26	8.59	7.68	77.79	6.97	25.81	2.71
1992	13.38	6.73	10.18	103.11	7.00	34.21	2.72
1993	12.76	10.31	8.98	90.92	7.51	30.17	1.60
1994	15.15	10.78	9.29	94.12	7.16	31.23	-0.29

Within the framework of modeled relationships, reduced crowding out has a direct effect on the availability of credit to the private sector and thus a direct impact on private investment which is a function of credit to the private sector. The increase in investment adds up to the stock of capital stock in the economy. Which in turn has a positive effect on output. Output in the economy is a function of the capital stock. This also increases the demand for labor or employment. An increase in domestic output has an impact on the supply of export

goods and demand for imports. The flow chart below, shows the transmission mechanism of crowding out.

There is a positive effect on nonwage incomes or property incomes. The impact is through domestic consumption, investment, exports and imports. There is an arrow that runs to and from imports and nonwage incomes. The reason is that within an economy investment expenditure by one investor is the income of another investment. These incomes may serve as a source of finance for investment. Nonwage incomes also increase because increased employment results in high consumption. Export incomes go to domestic producers. Domestic producers and workers may use there increased incomes to purchase imports domestic output or imports. Briefly speaking the net impact on investment and domestic output is positive as a result of reduced 'crowding out' and vice versa.

Figure 5: Flow Chart effects of Reduced Crowding Out



Simulation 3: Combined Effects of Increase in Borrowing and an Increase in Public Investment by Equal Amount K£ 100 million

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1979	7.26	2.43	8.24	83.48	3.23	27.70	-27.28
1980	-4.99	3.59	-5.54	-56.13	1.06	-18.62	-17.12
1981	8.53	-3.99	3.08	31.19	-0.96	10.35	-12.69
1982	-5.02	3.39	-3.68	-37.26	-0.23	-12.36	-9.30
1983	1.38	-2.05	0.78	7.95	-1.13	2.64	-6.76
1984	-0.73	1.76	-0.80	-8.13	-0.01	-2.70	-5.02
1985	-0.19	-0.57	-0.51	-5.19	-0.52	-1.72	-3.50
1986	0.92	0.16	0.23	2.35	-0.11	0.78	-2.54
1987	-0.80	0.18	-0.53	-5.33	-0.12	-1.77	-1.66
1988	0.55	-0.32	0.15	1.48	-0.15	0.49	-1.14
1989	-0.32	0.15	-0.16	-1.59	-0.00	-0.53	-0.72
1990	-0.05	-0.21	-0.04	-0.46	-0.08	-0.15	-0.43
1991	-0.02	-0.05	0.01	0.15	-0.01	0.05	-0.25
1992	-0.18	-0.08	-0.06	-0.60	-0.02	-0.20	-0.11
1993	-0.02	-0.11	0.02	0.20	-0.02	0.07	-0.03
1994	-0.13	-0.06	-0.02	-0.16	0.00	-0.05	0.03

Simulation 4: Combined Effects of a sustained Increase in Public Borrowing and Investment by K£ 100 million during 1990-1994

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Exports	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1990	4.97	2.12	7.25	73.46	2.84	24.37	-27.39
1991	1.88	5.65	3.73	37.73	4.30	12.52	-44.33
1992	8.02	2.99	4.78	48.44	3.33	16.07	-56.06
1993	5.75	5.09	3.05	30.89	3.07	10.25	-64.34
1994	6.17	4.53	2.86	28.98	2.32	9.62	-70.25

The tables above gives the net impact of a combined effect of increased government investment and borrowing of the same magnitude (not sustained) and sustained. The results above can be obtained by comparing the results from simulation 1 and simulation 2. It can be seen that the net impact on the economy of the combined effects is positive except for private investment. The negative impact of reduced credit to the private sector exceeds the positive impact through increased public investment.

The simulation results Simulation 2a above deserve some explanation, especially in relation to private investment. According to the results, a sustained increase in public investment will only result in increased private investment in the short and medium term, over a longer period of time private investment may start to decline. Private investment starts to decline because returns to private investment starts declining much faster. An analysis of the simulation results show that as government investment continually increases, the output capital ratio declines or in other words the incremental capital output ratio increases. Output increases less faster than increase in capital stock, this has a depressing effect on measure of returns to capital and utilization ratio. Further analysis of the simulation results reveal that nonwage incomes also increase less rapidly

Although in our model we do not model productivity, these results underscores the importance of productivity. A sustained increase in government investment will only result in a sustained increase in private investment if productivity and business incomes (nonwage incomes in our model) increase correspondingly. The variables in our model that affect nonwage incomes are: private consumption (positively), taxes (negatively), wage rate (negatively), imports (negatively), exports (positively) and gross investment (positively). Therefore within our framework of analysis. An increase in public investment should be combined with a proper mix of other policies that enhance productivity and or profits.

5.3.0: Impact of Increases in Treasury Bill Rate on the Macro economy

The government pursued a very tight monetary policy in early 1990s to curb inflation which increased from about 19.6 in 1991 to 27.5 in 1992 and further to 46 percent in 1993. This tight policy saw the rate on treasury bills increase from about 16.8 in 1991 to 17 in 1992 and further to about 40 percent in 1993. Overall real interest rates remained negative over this

period. As discussed above, other interest rates generally followed the trend in the movement of the treasury bill rate.

The impact of an increase in treasury bill rate (other interest rates generally follow the trend in TBRATE) is of interest because our modeled relationships reveal that an increase in deposit rates increase financial savings and thus the capacity of the financial sector to give credit. The opposing effect is that an increase in lending rates reduces demand for credit. Our results are given in the table below.

Simulation 5: Impact of a sustained Increases in Treasury Bill Rate by 5 % points during 1990-1994

Year	Net Impact on Private Consumption	Net Impact on Employment	Net Impact on Financial Savings	Net Impact on Real Imports	Net Impact on total Bank Credit	Net Impact on Real Output	Net Impact on Real Private Investment
1990	-0.90	-0.39	0.00	-13.31	-46.66	-4.41	-13.15
1991	2.71	-1.49	8.33	-19.30	-63.97	-6.40	-26.38
1992	6.44	-2.10	23.98	-24.49	-66.89	-8.12	-35.43
1993	8.03	-2.96	36.54	-26.89	-66.01	-8.92	-40.57
1994	9.25	-3.74	45.34	-27.55	-64.33	-9.14	-42.90

Our results show that an increase in the treasury bill rate results in an increase in both lending and saving deposit rates. The net impact on credit, private investment and output is negative. High deposit rates induce increased flow of resources to the formal banking system which has a positive impact on financial saving. There seem to be a positive impact on real private consumption after the first year. This positive response can be explained by the 'wealth effects' modeled in the consumption function. In the model, we use real financial assets as a proxy for wealth which has a positive impact on consumption. If we exclude the wealth effects from the consumption function, the net impact on private consumption is negative. The results indicate that higher interest rates may slow the economy despite positive impact on financial assets.

On the basis of the computer simulation experiments, we can not reject that government borrowing from the banking system may occasionally 'crowd out' private investment. If the government increases both borrowing and investment by an equal amount, there may be a marginal positive effect on output but private investment may not increase. The reason for this is because, the negative impact on private investment of a reduction by K£ 100 million in credit (credit to the government) more than outweighs the positive impact of K£ 100 million increase in public investment. The simulation experiments with the treasury bill rate reveal that increase in deposit rates may increase financial savings but since lending rates also increase, the net effect on credit and private investment is negative. Our results suggest that, raising the treasury bill rate may act as an effective restrictive policy instrument.