AN ECONOMETRIC ANALYSIS OF THE

SHORT-RUN VARIABILITY IN

CANADIAN OUTPUT AND PRICES

by

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TO THE MEMORY

OF

MY LATE MOTHER

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ABSTRACT

Providing a reasonable explanation for the business cycle has been the research agenda for many economists since the early 20th century. Most attempts to explain the sources of macroeconomic fluctuations attribute the variability in output and prices to only a few sources, sometimes to only one. While a significant amount of theoretical research has been undertaken on the business cycle, relatively little empirical work has been conducted that attempts to measure the quatitative importance of various sources of macroeconomic variability.

Macroeconometric models are typically detailed enough to allow a decomposition of output variability into a variety of constituent shocks. In these models, all macroeconomic fluctuation can be traced ultimately to equation residuals or exogenous variables. Ray Fair (1988) has undertaken stochastic simulations using his macroeconometric model of the U.S. economy to estimate the quantitative importance of various sources of variability in U.S. output and prices.

We have adopted Fair's methodology for application in a Canadian framework, using a quarterly Canadian macroeconometric model constructed specifically for the purpose. Fair's original technique and two variants of it are used. Bootstrapping, a distribution-free method, is used in addition to Fair's method, which assumes normally distributed shocks. In order to take into account shocks associated with exogenous variables, we have followed Fair and added autoregressive equations to the model. Using all these procedures, we have estimated the contribution of all the equation shocks in the model to the variances of three major endogenous variables, real GDP, the rate of change in the GDP price deflator and the rate of unemployment.

The results shows that, in the case of the variance of real GDP, export and import

equation shocks dominate and account for more than 55 percent of the variation over all quarters in eight-quarter simulations. Consumer expenditures on services, business fixed investment in machinery and equipment, consumer expenditures on nondurables, total imports, and consumer expenditures on semi-durables are among the other major contributors. The contributions of all the major contributors vary over the simulation period. While the contribution of consumer expenditures on durables, for example, increases from about -2 percent to about 10 percent, the contribution of consumer expenditures on services decreases from between 7 and 10 percent (depending on the method used) to about 3 or 4 percent. Since our simulations are limited to only eight periods, it is impossible to determine whether or not these contributions would stabilize over a longer simulation period.

The variances of the rate of change in the GDP deflator (PDOT) and the rate of unemployment (UNR) are similar to each other in that there are only a few major sources contributing to their variances and, unlike real GDP, the major contributors are the same across simulation periods, regardless of method. Their own shocks account for 100 percent of their variation in the first quarter of the simulation period, but a lesser proportion thereafter. The other main contributors are: domestic and U.S. rates of interest, the exchange rate, and the total private sector component of real GDP (in the case of PDOT) and total consumption, total investment, and total exports and imports (in the case of UNR). While some contributions increase significantly over the simulation period, others decrease. Thus a source that is dominant in the short run may be unimportant in the longer run and vice versa.

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TABLE OF CONTENTS

Abstract iv

Acknowledgements vi

List of Figures xii

List of Tables xv

Chapter 1: INTRODUCTION

1.1 Background and Motivation 1

1.2 Objective and Organization of the Study 8

Chapter 2: METHODOLOGICAL FRAMEWORK

2.1 Traditional Structural Macroeconometric Models 11

2.2 Vector Autoregression (VAR) Models 12

2.2.1 Standard VAR Approach 13

2.2.2 Structural VAR Approach 17

2.3 Index Models 19

2.4 Fair's Technique 22

2.5 Our Methodology 27

2.6 Bootstrapping 29

2.7 Summary 30

APPENDIX 2A 33

Chapter 3: THE MODEL

3.1 Introduction 45

3.2 Description of the Model 46

3.3 Concluding Remarks 59

Chapter 4: MODEL ESTIMATION AND HISTORICAL SIMULATION

4.1 Model Estimation 64

4.1.1 Estimation Technique 64

4.1.2 Summary of the Estimation Results 67

4.2 Historical Simulation 70

APPENDIX 4A: The Data 108

APPENDIX 4B

4B.1 Potential Output 114

4B.2 Capital Stock Series 117

Chapter 5: STOCHASTIC SIMULATION AND VARIANCE DECOMPOSITION

5.1 Stochastic Simulation (Fair's Technique and Bootstrapping) Based on 100 Trials 121

5.2 Stochastic Simulation (Fair's Technique) and Bootstrapping) Based on 1000 Trials 123

5.3 Precision of the Variance Decomposition Estimates 125

5.4 The Variance Decomposition Results 128

5.4.1 Organization of the Results 128

5.4.2 Contributions to the Variance of Real GDP 131

5.4.3 Contributions to the Variance of The Rate of Change in the GDP Price Deflator (PDOT) 134

5.4.4 Contributions to the Variance of The Rate of Unemployment (UNR) 135

5.5 Comparison With the Results of Other Studies 136

5.5.1 Comparison With Other Canadian Studies 137

5.5.2 Comparison with Fair's Results 140 for the U.S.

5.6 Summary 141

APPENDIX 5A 188

Chapter 6: CONCLUSIONS

6.1 Main Results of the Study 267

6.1.1 Real GDP 267

6.1.2 The Rate of Change in the GDP Price Deflator (PDOT) 269

6.1.3 The Rate of Unemployment (UNR) 270

6.2 Comparison With the Results of Other Studies 272

6.3 Suggestions for Future Research 276

BIBLIOGRAPHY 278

LIST OF FIGURES

FIGURE PAGE

Chapter: 3

3.1 Block Structure of the Model 60

Chapter: 4

4.1 Plot of the Actual and Simulated (Dynamic) Series of GDP 97

4.2 Plot of the Actual and Simulated (Dynamic) Series of Rate of Unemployment 97

4.3 Plot of the Actual and Simulated (Dynamic) Series of High Powered Money 98

4.4 Plot of the Actual and Simulated (Dynamic) Series of Rate of Change in GDP Deflator 98

4.5 Plot of the Actual and Simulated (Dynamic) Series of Consumer Expenditures on Durable 99

4.6 Plot of the Actual and Simulated (Dynamic) Series 99

	of Consumer Expenditures on Non-Durable	
4.7	Plot of the Actual and Simulated (Dynamic) Series of Consumer Expenditures on Semi-Durable	100
4.8	Plot of the Actual and Simulated (Dynamic) Series of Consumer Expenditures on Services	100
4.9	Plot of the Actual and Simulated (Dynamic) Series of Residential Business Investment	101
4.10	Plot of the Actual and Simulated (Dynamic) Series of Non-Residential Business Investment	101
4.11	Plot of the Actual and Simulated (Dynamic) Series of Machinery and Equipment Business Investment	102
4.12	Plot of the Actual and Simulated (Dynamic) Series of Non-Farm Business Inventories	102
4.13	Plot of the Actual and Simulated (Dynamic) Series of Imports	103
4.14	Plot of the Actual and Simulated (Dynamic) Series of Transfer payments	103
4.15	Plot of the Actual and Simulated (Dynamic) Series of Rate of Change in Nominal Wages	104
4.16	Plot of the Actual and Simulated (Dynamic) Series of Potential GDP	104

4.17	Plot of the Actual and Simulated (Dynamic) Series of Exchange Rate	105
4.18	Plot of the Actual and Simulated (Dynamic) Series of Domestic Rate of Interest	105
4.19	Plot of the Actual and Simulated (Dynamic) Series of Non-Labour Income	106
4.20	Plot of the Actual and Simulated (Dynamic) Series of Corporate Profits	106
4.21	Plot of the Actual and Simulated (Dynamic) Series of Personal Taxes	107
4.22	Plot of the Actual and Simulated (Dynamic) Series of Corporate Taxes	107

LIST OF TABLES

TABLE		PAGE
	Chapter: 3	
3.1	Selected Macroeconometric Models of the Canadian Economy	61
3.2	Major Characteristics of the Selected Macroeconometric Models of the Canadian Economy	62
	Chapter: 4	
4.1	Variables of the Model	74
4.2	Equations of the Model	80
4.3	Identities of the Model	88
4.4	Estimated Autoregressive (AR) Equations for Exogenous Variables	92
4.5	Results of Historical Simulation (Dynamic)	95
	Chapter: 5	
5.1	Variance Decomposition, METHOD 3 (Based on 100 Trials)	145
5.2	Grouping of Shocks for 1000 Trial Experiment	146
5.3	Variance Decomposition for Real GDP	147

METHOD 3 (Fair's technique)

5.4 Variance Decomposition for Rate of Unemployment 150

METHOD 3 (Fair's Technique)

5.5 Variance Decomposition for Rate of Inflation 153

METHOD 3 (Fair's Technique)

5.6 Variance Decomposition for Real GDP 156

METHOD 3 (Bootstrapping)

5.7 Variance Decomposition for Real GDP 159

METHOD 3 (Fair's technique)

5.8 Variance Decomposition for Rate of Inflation 162

METHOD 3 (Bootstrapping)

5.9 Variance Decomposition for Rate of Inflation 165

METHOD 3 (Fair's Technique)

5.10 Variance Decomposition for Rate of Unemployment 168

METHOD 3 (Bootstrapping)

5.11 Variance Decomposition for Rate of Unemployment 171

METHOD 3 (Fair's Technique)

5.12 Variance Decomposition for Real GDP 174

METHOD 1 (Fair's technique)

5.13 Variance Decomposition for Real GDP 177

METHOD 2 (Fair's technique)

5.14 Variance Decomposition for Real GDP 180
METHOD 1 (Bootstrapping)

5.15 Variance Decomposition for Real GDP 183
METHOD 2 (Bootstrapping)

5.16 Top Six Contributors to the Variance of GDP 186
(Based on METHOD 3)

5.17 Top Six Contributors to the Variance of PDOT 187
(Based on METHOD 3)

5.18 Top Six Contributors to the Variance of UNR 188
(Based on METHOD 3)

Appendix 5A

5A.1 Variance Decomposition for Real GDP 190
METHOD 3 (Fair's Technique): Based on 100 Trials

5A.2 Variance Decomposition for Real GDP 191
METHOD 3 (Bootstrapping): Based on 100 Trials

5A.3 Variance Decomposition for Rate of Unemployment 192
METHOD 3 (Fair's Technique): Based on 100 Trials

5A.4 Variance Decomposition for Rate of Unemployment 193
METHOD 3 (Bootstrapping): Based on 100 Trials

5A.5	Variance Decomposition for Rate of Inflation METHOD 3 (Fair's Technique): Based on 100 Trials	194
5A.6	Variance Decomposition for Rate of Inflation METHOD 3 (Bootstrapping): Based on 100 Trials	195
5A.7	Variance Decomposition for Rate of Inflation METHOD 1 (Fair's Technique)	196
5A.8	Variance Decomposition for Rate of Inflation METHOD 2 (Fair's Technique)	199
5A.9	Variance Decomposition for Rate of Unemployment METHOD 1 (Fair's Technique)	202
5A.10	Variance Decomposition for Rate of Unemployment METHOD 2 (Fair's Technique)	205
5A.11	Variance Decomposition for Rate of Inflation METHOD 1 (Bootstrapping)	208
5A.12	Variance Decomposition for Rate of Inflation METHOD 2 (Bootstrapping)	211
5A.13	Variance Decomposition for Rate of Unemployment METHOD 1 (Bootstrapping)	214
5A.14	Variance Decomposition for Rate of Unemployment METHOD 2 (Bootstrapping)	217
5A.15	Variance Decomposition for Real GDP	220

METHOD 3 (Bootstrapping): Sample Mean Subtracted from all the Residual Series Prior to Bootstrapping

5A.16 Precision of the Stochastic Simulation Estimates for Real GDP: METHOD 3 (Fair's Technique) 223

5A.17 Precision of the Stochastic Simulation Estimates for Real GDP: METHOD 3 (Bootstrapping) 230

5A.18 Precision of the Stochastic Simulation Estimates for Rate of Unemployment: METHOD 3 (Fair's Technique) 237

5A.19 Precision of the Stochastic Simulation Estimates for Rate of Unemployment: METHOD 3 (Bootstrapping) 244

5A.20 Precision of the Stochastic Simulation Estimates for Rate of Inflation: METHOD 3 (Bootstrapping) 251

5A.21 Precision of the Stochastic Simulation Estimates for Rate of Inflation: METHOD 3 (Fair's Technique) 258

Chapter 1

INTRODUCTION

1.1. Background and Motivation

Providing a reasonable explanation for the business cycle has been the research agenda for many economists since the early 20th century, from Mitchell (1913), Pigou (1927) and Adelman and Adelman (1959) to Lucas (1972), Black (1982) and King and Plosser (1984). For a review, see Zarnowitz (1985). Most attempts to explain the sources of macroeconomic fluctuations attribute the variability in output and prices to only a few sources, sometimes to only one. Kydland and Prescott (1982) and others proposed technology shocks as the main source of aggregate variability; Barro (1977) pointed to unanticipated changes in money stock; Lilien (1982) argued for 'unusual structural shifts' such as changes in the demand for goods relative to services, and Hamilton (1983) concluded in favour of oil price shocks.

As Shiller (1987) noted, various analysts have suggested qualitatively very different exogenous shocks as being important: changes in desired consumption, Hall (1986); breakdowns in the process of borrowing and lending, Bernanke (1981); and breakdowns or establishments of cartels, Rotemberg and Saloner (1986). Moreover, with increased macroeconomic interaction and interdependence, any of these shocks might occur in a foreign country, and be transmitted by trade or financial relations to the domestic country. It seems that there are many possible sources of variability, each of which might, in principle, contribute substantially.

While a significant amount of theoretical research has been undertaken on the business cycle, relatively little empirical work has been conducted that attempts to discriminate among the theories and to measure the quantitative importance of the various sources of macroeconomic variability. Recently, however, Ray Fair (1988) has undertaken stochastic simulations using his model of the U.S economy to estimate the quantitative importance of various sources of variability in U.S. output and prices. Motivated by his work, our interest is in estimating the contributions of potential sources to the fluctuations of Canadian output, prices and the rate of unemployment, incorporating as many variables as possible into the analysis. This task could be accomplished by using one of three types of model: i) a structural econometric model, ii) a vector autoregression (VAR) model, or iii) an index model. We discuss briefly each of these three kinds of models in turn.

The traditional structural econometric model in the oldest type, dating back to the pioneering work of Tinbergen (1939). It has been used widely during the past several decades. Models of this kind vary according to the level of disaggregation, with some models (especially the earlier ones) comprising only a few equations and others consisting of hundreds. While large-scale structural models have been used to investigate the effects of disaggregated shocks on economic activity (for example, Hickman, 1972), a summary of the contributions of such shocks has rarely been attempted. Structural econometric models have been criticized for their use in policy simulation experiments (Lucas, 1976), and for the identifying restrictions required to specify them (Sims, 1980).

An alternative to the traditional structural econometric modelling was introduced in 1980 by Christopher A. Sims. He suggested estimating a set of reduced form equations that treats all variables of interest as endogenous and use identical lags for every variable in every equation. This alternative technique is known as standard or unrestricted vector autoregression (VAR). It has been used widely in recent years, but has been criticized for its atheoretical nature, in the sense of having no explicit economic structure. An alternative VAR technique, termed "structural VAR", and proposed by Bernanke (1986), Blanchard (1986) and Sims (1986), retains some of the advantages of the standard VAR approach and makes it possible to explicitly identify and estimate a structural model. However, the structural VAR technique poses complicated computational problems when the number of endogenous variables is of even moderate size.

Index models are another type used by some analysts. Sargent and Sims (1980) used index models to study business cycles and Engle and Watson (1981) discussed the general class of index models. These models usually have been designed to explain the behaviour of a vector of time series variables in terms of a small set of unobservable ones and a set of error components that are specific to the particular series. Unlike traditional structural econometric models and VAR models, index models have not been used extensively.

We want to incorporate as many variables as possible into our analysis, and following Fair (1988) we choose to work with a traditional structural econometric model. We have adopted and extended Fair's technique, which appears up to now to have been applied only to the U.S. economy. He has used his econometric model of the U.S. to estimate the quantitative importance of various sources of variability by means of stochastic simulation. Once the model has been specified and estimated using an appropriate technique, stochastic simulation can be employed to estimate the variances of the endogenous variables. In stochastic simulation, a random shock drawn from an appropriate multivariate distribution is added to each behavioral equation each time the model is solved. This procedure is repeated a large number of times for each of several periods in such a way as to produce a distribution of outcomes.

In order to demonstrate how stochastic simulations can be used to estimate the variance of a particular endogenous variable, we consider the general nonlinear model

$$g_i(Y_t, X_t, \alpha_i) = u_{it}, \quad i=1,2,\ldots,m,\ldots,n \quad t=1,2,\ldots,T \qquad (1.1)$$

Y_t is a vector of endogenous variables at time t, X_t is a vector of lagged endogenous and exogenous variables, and α_i is a vector of the unknown coefficients of the ith equation of the model. There is a total of n equations, m of which are stochastic and (n-m) non-stochastic (model identities). For the m stochastic equations, $u_t = (u_{1t}, u_{2t}, \ldots, u_{mt})'$ is the vector of structural disturbances at time t, assumed to be independently and identically distributed as multivariate normal $N(0, \Sigma)$, where Σ is an mxm symmetric matrix. Σ can be estimated by

$$\hat{\Sigma} = \frac{1}{T} \sum_{i=1}^{T} \hat{u}_t \hat{u}_t'$$

where $\hat{u}_t$ is the vector of computed residuals corresponding to u_t .

In order to take into account shocks associated with exogenous variables one can add to the model a set of autoregressive equations for those variables, and consider the variance covariance matrix to be of the order (m+k)x(m+k), k being the number of exogenous variables.

Let us now consider the following transformation:

$$D = PR \quad , \quad \text{(1.2)}$$

where P is an (m+k)x(m+k) lower triangular matrix obtained by a Choleski decomposition of $\hat{\Sigma}$ such that $P'P = \hat{\Sigma}$.

To solve the model for q periods, an (m+k)xq matrix R of random numbers is generated from a multivariate normal distribution with mean zero and unit variance. D is an (m+k)xq matrix of shocks to be used in one simulation of the model over q periods. Dynamic stochastic simulation requires that the model be solved for the first period first. The first-period solved values are then used as lagged right-hand-side (R.H.S.) variables, along with the second period shocks, to solve the model for the second period, and so on up to the qth period. This process can be repeated Z times, where Z is some appropriately large number of replications. Z simulated values of all endogenous variables are thus obtained for each of the q periods.

Let y_{it}^{z} denote the simulated value of variable i in period t of replication z.

The estimate of the expected value of variable i for period t, denoted $\hat{\mu}_{it}$, is then

$$\hat{\beta}_{it} = \left(\frac{1}{Z}\right) \sum_{z=1}^{Z} y_{it}^{z} \qquad (1.3)$$

The estimate of the variance of variable i for period t, denoted $\hat{\sigma}_{it}^{2}$, is

$$\hat{\sigma}_{it}^{2} = \left(\frac{1}{Z}\right) \sum_{z=1}^{Z} (y_{it}^{z} - \hat{\beta}_{it})^{2} \qquad (1.4)$$

Now let $\hat{\sigma}_{it}^{2}(g)$ be the estimated variance of variable i for period t when the error term in the gth equation is fixed at its expected value (zero). (In terms of the above notation, this can be achieved by setting the relevant rows of the matrix P to zero.) Let $\hat{\delta}_{it}(g)$ be the difference between the two estimated variances:

$$\hat{\delta}_{it}(g) = \hat{\sigma}_{it}^{2} - \hat{\sigma}_{it}^{2}(g) \qquad (1.5)$$

The contribution of the gth equation error to the total variance of variable i for period t, in percentage form, is then estimated as

$$C_{it}^{g} = 100\,[\hat{\delta}_{it}(g) \;/\; \hat{\sigma}_{it}^{2}] \qquad (1.6)$$

It is important to understand just what is being estimated here. Consider in particular an exogenous-variable shock. What is being estimated is the contribution of the error term in the (autoregressive) exogenous-variable equation to the variance of endogenous variable i. This contribution is different from the multiplier effect of the exogenous variable on endogenous variable i; the multiplier effect includes the effect of the systematic component of the exogenous variable, as well as the random error component.

1.2. Objective and Organization of the Study

The basic purposes of the research reported in this thesis are to apply Fair's procedures in a Canadian framework, using a Canadian macroeconometric model, to introduce some extensions and refinements of his procedures, and to interpret the results. Two variants of Fair's basic technique are used; in addition, bootstrapping, a distribution-free method, is employed as an alternative to Fair's original method, which assumes normally distributed shocks. **D** when the bootstrapping approach is used, is defined as a matrix the elements of which are drawn from actual residuals of the model equations, rather than from a multivariate normal distribution. **D** is recalculated for each replication by resampling the residuals, with replacement. The rest of the procedure, to estimate the variances, etc., is similar to Fair's method, as described above.

We have developed and estimated a quarterly econometric model that is as highly disaggregated as was feasible within the time available. The model has 71 equations, 22 are behavioral and 49 are identities. (The exogenous-variable autoregressive equations add another eight to the model.) Most of the equations were estimated over a sample period from 1962 quarter four to 1988 quarter four, by a variant of two stage least squares in which sixteen principle components are used as instruments. (A few of the equations were estimated for a shorter period, as discussed later.)

Chapter 2 describes the methodological framework: the methodology used is discussed in more detail and a review of other methodologies and of relevant studies with Canadian emphasis is provided. Chapter 3 gives a full description of the econometric model used in the present study. How the equations were estimated and how dynamic and static simulations were carried out to check the model's ability to replicate actual historical time series are the subject of chapter 4. Chapter 5 provides detailed results of the stochastic simulations and the variance decompositions for real Gross Domestic Product, the rate of change in the GDP price deflator, and the rate of unemployment. Chapter 6 reviews the major results of the study, offers a comparison with the results of some other Canadian studies, and suggest some possibilities for further research.

Chapter 2

METHODOLOGICAL FRAMEWORK

The models in the literature that are used to quantitatively analyze the sources of macroeconomic fluctuations can be classified as follows:

(i) Structural Econometric Models. (Pioneered by Tinbergen in the 1930's)

(ii) Vector Autoregression (VAR) Models. (Introduced by Sims (1980))

(iii) Index Models. (As used by Sargent and Sims (1980), and Engle and Watson (1981))

(iv) Fair's (1988) Technique[1].

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[1] Although Fair's technique uses a structural econometric model, we have classified his technique separately because it uses these models in a new way.

Before elaborating on method (iv) which is used in this thesis, we will briefly review the other three methodologies in the order listed above, citing the relevant studies with Canadian emphasis.

2.1. Traditional Structural Macroeconometric Models

Since the pioneering work of Tinbergen (1939) and early efforts of Lawrence R. Klein (1950) in the field of econometric modelling, a number of econometric models have been built in different countries to serve a variety of objectives. See Epstein (1987), Morgan (1990), and Bodkin et al. (1991)[2] for a history of macroeconometric model-building. Such models generally: (i) utilize a Keynesian framework for the determination of national income and its components, as well as other macroeconomic variables, such as the distribution of income, prices, wages, interest rates, unemployment, production and assets, and (ii) are used for the purpose of structural analysis, forecasting and policy evaluation. These models also vary according to the level of disaggregation, from models comprising only few equations to models consisting of hundreds of equations. While large scale econometric models have investigated the effects of disaggregated shocks on economic activity, see for example Hickman (1972), a summary of the contributions of such shocks has rarely been calculated. Recently, Fair (1988) has used his econometric

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[2] It also includes a survey of Canadian macroeconometric modelling.

model of the U.S. economy to estimate the quantitative importance of various sources of variability by means of stochastic simulation, which will be discussed in the section 2.4.

Although macroeconometric models have been used widely over the past few decades, they have also come under severe criticism. Since it is a common feature of econometric models that the parameters are assumed to be time invariant, Lucas (1976) undermines the use of econometric models for policy simulation experiments, since he argues that the parameters (private behaviour) could not assumed to remain unchanged in the face of arbitrary changes in policy parameters. This criticism is known as the Lucas critique. More recent criticism came from Sims (1980) who argued that the identifying restrictions, usually used to specify an econometric model, are not derived "by invoking economic theory". Alternatively he suggested estimating a set of reduced form equations treating all variables of interest as endogenous with identical lags given to each variable in every equation.

This alternative technique, known as "Vector Autoregression" or VAR, is the topic of our next section.

2.2. Vector Autoregression (VAR) Models

The technique was first introduced by Sims (1980) as an alternative to traditional structural macroeconometric modelling. The VAR methodology has widely been used during the last decade. We will first briefly outline the standard VAR methodology, and cite some of the Canadian studies.

2.2.1. Standard VAR Approach

The form of the dynamic structural macroeconomic model is generally defined as:

$$AY_t = \sum_{i=1}^{q} B_i Y_{t-i} + DU_t \qquad (2.2.1)$$

Where $Y_t = (Y_{1t}, Y_{2t}, \ldots, Y_{nt})'$ is a vector of n endogenous variables; $U_t = (U_{1t}, U_{2t}, \ldots, U_{nt})'$ is vector of n structural disturbances with $E(U_t) = 0$ and by definition, is contemporaneously and serially uncorrelated. A is an nxn matrix of coefficients of the current endogenous variables. B_i is an nxn matrix of coefficients of the same endogenous variables lagged i periods. The nxn matrix D is normalized with unit values on its diagonal. Off-diagonal elements, if non-zero, allow the simultaneous impact of a structural disturbance on more than one equation.

Usually VAR studies also include seasonal dummies, a trend, and a constant as explanatory variables. Since these variables are of limited interest, we have decided not to include them in this exposition.

The first step in the standard VAR approaches to estimate the reduced form of (2.2.1):[3]

$$Y_t = \sum_{i=1}^{q} H_i Y_{t-i} + V_t \, , \qquad \text{(2.2.2)}$$

where $H_i = A^{-1}B_i$ and $V_t = A^{-1}DU_t$.

Impulse response functions (IRFs) and forecast error variance decompositions (FEVDs) are usually then constructed to interpret the model. IRFs traces the response of the endogenous variables over time to a shock in one of the endogenous variables at a given point in time. The construction of IRFs & FEVDs would be an straightforward exercise if the disturbances are not correlated contemporaneously. But since VAR disturbances are generally characterized by such correlations, i.e $\Sigma = E(V_t V_t')$ is not diagonal, an IRF is, for example, the response of an endogenous variable not to a shock in the one chosen endogenous variable, but in fact to shocks in all variables that are contemporaneously correlated with it. To deal with this problem, the second step of the standard VAR approach employs orthogonal innovations. If we choose any matrix G so that

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[3] Since the VAR model can be viewed as a system of reduced form equations with right hand side variables being the same for each equation, OLS applied to each equation separately, gives efficient estimates of the model.

$G^{-1}\Sigma G'^{-1} = I$, then the new innovations

$$W_t = G^{-1}V_t \qquad \text{(2.2.3)}$$

satisfy $E(W_t W_t') = I$. These orthogonalized innovations have the convenient property that they are uncorrelated both across time and across equations. Such a matrix G can be obtained by a Choleski factorization of the estimated covariance matrix, Σ. Substituting (2.2.3) into (2.2.2) gives

$$Y_t = \sum_{i=1}^{q} H_i Y_{t-i} + GW_t \, . \qquad \text{(2.2.4)}$$

The VAR model is then manipulated into a moving average representation, writing (2.2.4) as:

$$Y_t = \sum_{i=0}^{\infty} S_i W_{t-i-1} \qquad \text{(2.2.5)}$$

(2.2.5) can obtained simply by successive substitution of lagged Y's into (2.2.4). The elements of S_i contain the elements of both the G and the H_i matrices.

This standard VAR approach has been employed by some researchers to study the Canadian-American macroeconomic interaction. These include the studies by Burbidge and Harrison (1985), Kusczak and Murray (1987) and Ambler (1989).

The standard VAR approach has been criticized primarily for its atheoretical nature, in the sense of not having any explicit economic structure[4]. The use of orthogonalized innovations is widely been criticized as a deficiency of the technique. See, for example, Leamer (1985), Cooley and Leroy (1985), Sims (1982, 1986), and Sargent (1984). It has been argued that the orthogonalized innovations, W_t , can be interpreted as economic events only if a set of identification restrictions is assumed to be valid in the structural model (2.2.1). These identification restrictions, neatly summarized by Johnson & Schembri (1989), are: (i) that the model has null set X_t or that all X_t variables appear in all equations, (ii) that the matrix D is diagonal, and (iii) that the matrix A is lower triangular with unit values on the diagonal. The structural model would then be strictly recursive. The orthogonalized innovations also make the ordering of the variables in the VAR system important. Since empirically VAR results are found to be sensitive, to the ordering of the variables. See Spencer (1989).

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[4] All the Canadian studies cited are subject to this criticism.

2.2.2. Structural VAR Approach

An alternative VAR technique has been proposed by Bernanke (1986), Blanchard (1986) and Sims (1986) which retains some of the advantages of the standard VAR approach and makes it possible to explicitly identify and estimate the structural model, thus not requiring it to be strictly recursive. This 'Structural VAR' approach retains the first step of standard VAR approach, i.e, estimating (2.1.2), then extracting some of the structural parameters. The second step, however, is different and requires estimating the following relationship:

$$E[V_t V_t'] = E[A^{-1} D U_t U_t' D' (A^{-1})'] \quad \text{......} (2.2.6)$$

Let $\psi_{nxn} = E[V_t V_t']$ and $\phi_{nxn} = E[U_t U_t']$.

Rewriting (2.2.6) as:

$$\psi_{nxn} = A^{-1} D \phi D' (A^{-1})' , \quad \text{......} (2.2.7)$$

(2.2.7) contains a system of equations that are non-linear in the elements of A & D. The second step uses this relationship to recover $3n^2$ unknown elements of the matrices A, D and ϕ . Since ψ contains only [n(n+1)/2] pieces of information, one needs some identifying restrictions on A, D and ϕ . n diagonal elements of A and n diagonal elements of D can be normalized to unity. With n elements of ϕ (the variances of the n structural disturbances U_t) to be estimated, a total of [(n(n+1)/2) - n] off-diagonal elements of A and D can then be estimated. The recovery of the structural parameters would make it possible to write the entire structural model and then convert it to a moving average form to consider structural disturbances as sources of economic fluctuations. This time the shocks will have a structural interpretation.

Structural VAR approaches have been employed by Johnson and Schembri (1989), Racette and Reynauld (1992) and Nadeem (1991) to analyze Canadian-American macroeconomic interactions.

Contrary to the standard VAR approach, the structural VAR approach involves a complicated computational problem involving a large system of equations. As noted earlier, (2.2.7) is a system of nonlinear equations. A 5 variable model requires the solution of 15 nonlinear equations, for example. Johnson and Schembri (1989) have attempted larger models but convergent solutions to the system of nonlinear equations proved difficult to obtain.

2.3. Index Models

Index models usually have been designed to explain the behaviour of a vector of a time series in terms of a small set of unobservable variables and a set of error components which are specific to the particular series. See, for example, Sargent and Sims (1980) who have used index models to study business cycles and Engle and Watson (1981) who discussed the general class of index models.

Altonji and Ham (1990) have used an index model of the type discussed in Engle and Watson (1981) in an attempt to assess the impact of external, national, and sectoral shocks on Canadian employment fluctuations at the national, industry, and provincial levels. The methodology used in their paper can be described briefly in the following steps[5]:

1) Specify a general time series model of employment at the province-industry level with I industries and P provinces as:

$$Y_t = \lambda + \Pi Y_{t-1} + B_1 US_t + B_2 US_{t-1} + \epsilon_t \,, \qquad \text{.......................} (2.3.1)$$

where $Y_t = (Y_{11t}, Y_{12t}, \ldots Y_{1It}, Y_{21t}, \ldots Y_{PIt})'$ is an IPx1 column vector with Y_{pit} being the

5 See also Norrbin and Schlagenhauf (1988) for a similar study in a U.S. framework using quarterly data covering the period 1954-1984. They have employed a dynamic factor analysis technique, a different methodology from the one used by Altonji and Ham.

change in the log of employment in province p and industry i. λ is an IPx1 vector of intercepts, Π is an IPxIP matrix of lag coefficients, $\epsilon_t = (\epsilon_{11t}, \epsilon_{12t}, ... \epsilon_{1It}, \epsilon_{2It}, ... \epsilon_{PIt})'$ is an IPx1 vector of error terms, US_t denotes the growth in real U.S. GNP, and B_1 and B_2 are IPx1 vectors of coefficients.

2) They work with nine one-digit industries and six provinces, amounting to 54 lag coefficients to be estimated. Since they have only 19 time series observations for each equation, they have imposed a series of restrictions on the feedback coefficients Π as well as on the λ, B_1, B_2 vectors, in order to make (2.3.1) estimable.

3) To assess the relative importance of U.S., national, industry, and provincial shocks in Canadian employment variation, they decompose the employment disturbance ϵ_{pit} as

$$\epsilon_{pit} = f_i C_t + H_{it} + g_i v_{pt} + u_{pit} \qquad (2.3.2)$$

where C_t represents the Canadian national shock affecting all province-industry pairs with industry specific coefficients f_i, H_{it} represents an industry specific shock affecting industry i, v_{pt} represents a province specific shock affecting all industries in province p with industry specific weight g_i, and u_{pit} reflects special conditions affecting only industry i in province p. They assume that all shocks are mutually uncorrelated at all leads and lags. 4) They employ a two-step estimation strategy. In the first step, they estimate the regression parameters of (2.3.1) using instrumental variables and least squares procedures. Estimated regression parameters are than used to provide the estimate for ϵ_t, called $\hat{\epsilon}_t$. In the second stage they estimate the coefficients and variances of the error component model (2.3.2) from sample covariances of $\hat{\epsilon}_t\hat{\epsilon}_t'$

5) Finally, from the moving average representation of the model they derive an expression for the total contribution of each shock to the steady state variance of Y_t.

They have found the U.S. shock as the dominant source, accounting for about seventy percent of the variation in Canadian employment growth. The Canadian national shock accounts for about twenty percent, the remaining industry specific, province specific, and province-industry specific shocks together account for about ten percent of the variation of Canadian employment growth.

2.4. Fair's Technique

As Bodkin et al. (1991) have noted, Nagar (1969) first applied general stochastic simulation[6] to the large scale Brookings model in the late 1960's to analyze the simulation paths of selected endogenous variables. Recently, Fair (1988) has used his econometric model of U.S economy to estimate the quantitative importance of various sources of variability by means of stochastic simulation. Having the model specified and estimated using any appropriate estimation technique, stochastic simulation can be used to estimate the variances of endogenous variables in the model. In stochastic simulation, a random shock, drawn from a multivariate distribution which should reflect the stochastic properties of the true model as much as possible, is added to each behavioral equation each time the model is solved. The solution with random shocks can be replicated a number of times for each period in such a way as to produce a distribution of outcomes.

The methodology adopted by Fair can be described in general form as follows:

Writing the model as

$$g_i(Y_t, X_t, \alpha_i) = u_{it}, \; i=1,2,...m,...,n \quad t=1,2,...,T \qquad \text{.......................... (2.4.1)}$$

Y_t is a vector of endogenous variables at time t, X_t is a vector of lagged endogenous and

[6] The technique was extended by McCarthy (1972) and adopted by most analysts in stochastic simulation exercises.

exogenous variables, and α_i is a vector of the unknown coefficients of the ith equation of the model. There is a total of n equations, m of which are stochastic and (n-m) non-stochastic (model identities). For the m stochastic equations, $u_t = (u_{1t}, u_{2t}, \ldots, u_{mt})'$ is the vector of structural disturbances at time t, assumed to be independently and identically distributed as multivariate normal $N(0,\Sigma)$, where Σ is an mxm symmetric matrix with typical element σ_{ij} being the covariance between the contemporaneous disturbances in the ith and jth equations. It can be estimated as:

$$\hat{\Sigma} = \frac{1}{T}\sum_{i=1}^{T} \hat{u}_t \hat{u}_t'$$

where $\hat{u}_t$ is the vector of comuted residuals corresponding to U_t .

In order to take into account shocks associated with exogenous variables one can model them with autoregressive equations[7], and then consider the variance covariance matrix

[7] Another possibility, as Fair (1988) has mentioned, is to assume that exogenous variable shocks are the errors that forecasting services make in their forecasts of exogenous variables.

to be (m+k)x(m+k)[8] with k being the number of exogenous variables in the model. Let us now consider the following transformation:

$$D = PR\,, \qquad (2.4.2)$$

where P is an (m+k)x(m+k) lower triangular matrix obtained by taking a Choleski decomposition of Σ such that $P^{\prime}P = \Sigma$, and **D** and **R** are described below.

To solve the model for q periods, R is an (m+k)xq matrix of random numbers where each element is independently drawn from a normal distribution with mean zero and unit variance. **D** is a (m+k)xq matrix of shocks to be used in one simulation of the model for q periods. First, the dynamic stochastic simulation solves the model for the first period.[9] These solved values are then used as lagged right-hand-side variables along with a new column of **D** to solve the model for the second period, etc.. The model can be simulated Z times for q periods by generating **R**, and hence **D**, Z times. This gives Z simulated values of all endogenous variables for q periods.

Let y_{it}^{z} denote the simulated value of variable i for period t when the model is simulated for the zth time. For a total of Z simulations, the estimate of the expected value

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[8] In estimating the variance covariance matrix, Fair has assumed the errors of structural equations to be uncorrelated with the errors of exogenous variable equations and has taken it to be block diagonal(with mxm block and kxk block). As we will see in chapter 5, this assumption has significant effects on results.

[9] One must select initial starting values for the lagged variables. These, as in Fair's case, could be the actual values.

of variable i for period t, denoted $\hat{\mu}_{it}$, is

$$\hat{\mu}_{it} = \left(\frac{1}{Z}\right) \sum_{z=1}^{Z} y_{it}^{z} \quad \text{(2.4.3)}$$

The estimate of the variance of variable i for period t, denoted

by, $\hat{\sigma}_{it}^2$, is

$$\hat{\sigma}_{it}^2 = \left(\frac{1}{Z}\right) \sum_{z=1}^{Z} (y_{it}^{z} - \hat{\mu}_{it})^2. \quad \text{(2.4.4)}$$

We will refer to $\hat{\sigma}_{it}^2$ as a " **Base Variance**".

Now let $\hat{\sigma}_{it}^2(g)$ be the estimated variance of variable i for period t when the error term in the gth[10] equation is fixed at zero, its expected value. In terms of the above notation,

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[10] Although g could refer to a subset of equations, we will assume here that g refers to a single equation.

this can be achieved by setting the relevant rows of the matrix P to zero. Let $\hat{\delta}_{it}(g)$ be the difference between the two estimated variances[11]:

$$\hat{\delta}_{it}(g) = \hat{\sigma}_{it}^2 - \hat{\sigma}_{it}^2(g) \quad \text{.......} \quad (2.4.5)$$

Expressing the contribution of the error in the gth equation to the total variance of variable i for period t in percentage form as:

$$C_{it}^g = 100[\hat{\delta}_{it}(g) \;/\; \hat{\sigma}_{it}^2], \quad \text{.......} \quad (2.4.6)$$

then one would expect that

$$\sum_{g=1}^{m+k} C_{it}^g = 100, \quad \text{.......} \quad (2.4.7)$$

i.e that the base variance should approximately equal the sum of the individual contributions to that variation. We find (see chapter 5) that (2.4.7) is violated significantly. This leads us to extend Fair's method, in a way described below.

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[11] In estimating $\hat{\sigma}_{it}^2$ and $\hat{\sigma}_{it}^2(g)$. the same R's were used. See chapter 5 for more discussion.

2.5. Our Methodology

As Fair has mentioned, another way of estimating $\hat{\sigma}_{it}^2(g)$ is to draw just the gth error term and set the rest to zero. Denoting this variance as $\hat{\theta}_{it}^2(g)$, the contribution of the gth error in the total variance of variable i for period t, in percentage form, denoted as D_{it}^g, is:

$$D_{it}^g = 100[\hat{\theta}_{it}^2(g)/\hat{\sigma}_{it}^2] \qquad (2.4.8)$$

One would again expect that:

$$\sum_{g=1}^{m+k} D_{it}^g \simeq 100 \qquad (2.4.9)$$

Although Fair noticed that these two procedures are not the same if the error term in equation g is correlated with other error terms in the model, he was fortunate that the effect of this correlation was fairly small, inducing him to base his results on the first method. We, however, found that these two methods give significantly different results. Using the method first it was generally the case that

$$\sum_{g=1}^{m+k} C_{ir}^{g} < 100 \qquad (2.4.10)$$

and using the second method it was generally the case[12] that

$$\sum_{g=1}^{m+k} D_{it}^{g} > 100. \qquad (2.4.11)$$

Combing the two, it was also generally the case that

$$[\sum_{g=1}^{m+k} C_{it}^{g} + \sum_{g=1}^{m+k} D_{it}^{g}]/2 \approx 100 \qquad (2.4.12)$$

We have estimated both C_{it}^{g} and D_{it}^{g} according to (2.4.6) & (2.4.8) and took the

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[12] Theoretically both sums can either be greater or less than one hundred. See appendix 2A.1.

average of these two for the final interpretation of our results. i.e.

$$S_{it}^{g} - [C_{it}^{g} + D_{it}^{g}]/2 \quad \text{.......} \quad (2.4.13)$$

In the appendix 2.A of this chapter we have shown why, instead of choosing one of the two methods, taking the average is more likely to satisfy this approximate "adding up" property. In the same appendix, we have also shown how to calculate the stochastic simulation-error variances[13] for all three methods.

From now on, we will refer equation (2.4.6) as **METHOD 1**, equation (2.4.8) as **METHOD 2** and equation (2.4.13) as **METHOD 3**.

2.6. Bootstrapping

The bootstrap is a relatively new statistical technique invented by Efron (1979, 1982). It is basically a procedure for estimating standard errors by resampling the data in a suitable way. The idea has been employed by researchers for many applications. Freedman and Peters (1984), for example, applied the bootstrap to an econometric model to attach standard errors to coefficient estimates and forecasts have demonstrated that the

[13] Fair (1988), has shown the calculation of these variances for METHOD 1, we have just reproduced these calculations, using bit different notation. In addition, we have also shown the same calculations for METHOD 2 and METHOD 3.

usual asymptotic methods seem unsatisfactory. It has also been employed in forecasting and as a tool for verification. See Veall (1989), who emphasizes the usefulness of the bootstrap in most applied econometric exercises, and gives a brief review of these applications and other references to the bootstrap literature.

As Veall (1989) has noted, the application of bootstrap-type simulation methods in econometrics is not common[14]. We have employed the bootstrap idea for the purpose of stochastic simulation. As compared to Fair's method, in which shocks are drawn from a multivariate normal distribution, bootstrap draws shocks from the empirical distribution of residuals from the real data. In terms of the notation used above, $\mathbf{D}^{\prime}$ in this case is an qx(m+k) matrix of numbers drawn from actual residuals of the model equations. Each row of $\mathbf{D}^{\prime}$ is a draw of an m+k vector of residuals from a single time period. In this way, the covariances among the errors are captured. $\mathbf{D}^{\prime}$ is redefined, through resampling of actual residuals, each time the model is being simulated. The rest of the procedure, estimating the variances, etc., is similar to the one already described.

2.7. Summary

The traditional structural econometric models are the oldest, starting with the pioneering work of Tinbergen (1939), and have been used widely during the past few decades. These

[14] Becoming more common only over the past few years.

models vary according to the level of disaggregation with some models comprising only a few equations and others consisting of hundreds of equations. While large scale econometric models have been used to investigate the effects of disaggregated shocks on economic activity [for example, Hickman (1972)] a summary of the contributions of such shocks has rarely been calculated. These econometric models have been criticized for their use in policy simulation experiments [Lucas (1976)] and for the identifying restrictions used to specify them [Sims (1980)].

An alternative to the traditional structural econometric modelling was introduced in 1980 by Sims. He suggested estimating a set of reduced form equations which treat all variables of interest as endogenous and use an identical number of lags for every variable in every equation. This technique is known as the " Standard Vector Autoregression (VAR)". It has been used widely over the past few years, but has been criticized for its atheoretical nature, in the sense of having no explicit economic structure. An alternative VAR technique, termed as a "structural VAR", has been proposed by Bernanke (1986), Blanchard (1986) and Sims (1986). It retains some of the advantages of the standard VAR approach and makes it possible to explicitly identify and estimate the structural model. However, the structural VAR technique poses complicated computational problems when there are many endogenous variables.

Index models are another method used by some analysts. Sargent and Sims (1980) have used them to study business cycles and Engle and Watson (1981) discussed the general class of index models. These models usually have been designed to explain the behaviour of a vector of time series variables in terms of a small set of unobservable variables and a set of error components which are specific to the particular series. Unlike traditional structural econometric models and the VAR models, index models have not been used a great deal.

Since we want to incorporate as many variables as possible in our analysis, we choose to work with a traditional structural econometric model, which is subject to the Lucas critique, but is typically detailed enough to allow a decomposition of output variability into a variety of constituent shocks. Index models are suitable only for a small number of variables. The standard VAR technique could also be employed to analyze a system with a large number of variables, but then one has to compromise on the atheoretical nature of the approach. On the other hand, the structural VAR technique, as noted earlier, doesn't allow one to analyze a system with a large number of variables because of difficult computational problems.

We have adopted and extended Fair's (1988) technique who used his econometric model of the U.S. economy to estimate the quantitative importance of various sources of variability by means of stochastic simulation. Since Fair's technique is relatively new and has been applied only to a U.S economy, we have employed it in a Canadian framework. We have also used bootstrapping, a distribution free procedure, thus making it possible to compare results from the two methodologies.

Appendix 2A

2A.1. The Sums of all Contributions

C_{it}^{g} , D_{it}^{g} and S_{it}^{g}

In this section we will provide some theoretical basis for the violation of equations (2.4.6) & (2.4.8) and will demonstrate: (i) why the sums of all contributions, C_{it}^{g} & D_{it}^{g} , can either be less or greater than hundred and (ii) why the average of the two sums, S_{it}^{g} , is likely to come closer to satisfying this "adding up" property.

To avoid notational complication, we drop the subscript 'it' and assume that the following discussion pertains to variable i for period t.

For demonstration purposes we will consider the example, where y = U1 + U2 + U3 with U's being stochastic variables. The total variance of y when all the error terms are drawn can be expressed as:

$$\text{var}(y \mid y = u1 + u2 + u3) = \hat{\sigma}^2$$

$$= \text{var}(u1) + \text{var}(u2) + \text{var}(u3) + 2\text{cov}(u1,u2) + 2\text{cov}(u1,u3) + 2\text{cov}(u2,u3) \quad \text{.............................} \quad (2A.1)$$

According to Method 1

In method 1, the shocks are set to zero one by one

$$\text{var}(y \mid y = u2 + u3) = \hat{\sigma}^2(u1) = \text{var}(u2) + \text{var}(u3) + 2\text{cov}(u2,u3)$$

$$\text{var}(y \mid y = u1 + u3) = \hat{\sigma}^2(u2) = \text{var}(u1) + \text{var}(u3) + 2\text{cov}(u1,u3)$$

$$\text{var}(y \mid y = u1 + u2) = \hat{\sigma}^2(u3) = \text{var}(u1) + \text{var}(u2) + 2\text{cov}(u1,u2)$$

Then the variance difference when u1 = 0 would be :

$$\hat{\delta}(u1) - \hat{\sigma}^2 - \hat{\sigma}^2(u1) = \text{var}(u1) + 2\,\text{cov}(u1,u2) + 2\,\text{cov}(u1,u3),$$

the variance difference when u2 = 0 would be :

$$\hat{\delta}(u2) = \hat{\sigma}^2 - \hat{\sigma}^2(u2) \quad = \mathrm{var}(u2) + 2\ \mathrm{cov}(u1,u3) + 2\ \mathrm{cov}(u2,u3),$$

and the variance difference when u3 = 0 would be :

$$\hat{\delta}(u3) = \hat{\sigma}^2 - \hat{\sigma}^2(u3) \quad = \mathrm{var}(u3) + 2\ \mathrm{cov}(u1,u3) + 2\ \mathrm{cov}(u2,u3)\ .$$

The sum of three variance differences, denoted by $\hat{\sigma}^2(\mathbf{1})$, is then

$$\hat{\sigma}^2(\mathbf{1}) = \hat{\sigma}^2 + \xi, \qquad \text{(2A.2)}$$

where $\xi = 2[cov(u1,u2)+cov(u1,u3)+cov(u2,u3)]$.

Since $\xi \neq 0$ in general, then $\hat{\sigma}^2(\mathbf{1}) \neq \hat{\sigma}^2$.

According to Method 2

var(y | y = u2 + u3) = $\hat{\theta}^2(u1)$ = var(u1)

var(y | y = u1 + u3) = $\hat{\theta}^2(u2)$ = var(u2) var(y | y = u1 + u2) = $\hat{\theta}^2(u3)$ = var(u3)

The sum of these three variances, denoted by $\hat{\sigma}^2(2)$, is:

$$\hat{\sigma}^2(2) - \hat{\sigma}^2 - \xi \qquad \text{(2A.3)}$$

and therefore $\hat{\sigma}^2(2) \neq \hat{\sigma}^2$.

Now the average sum of the two methods (Method 3) will be

$$\hat{\sigma}^2(A) - [\hat{\sigma}^2(1) + \hat{\sigma}^2(2)]/2$$

$$= [(\hat{\sigma}^2 + \xi) + (\hat{\sigma}^2 - \xi)]/2$$

$$= \hat{\sigma}^2 \qquad \text{(2A.4)}$$

Since the differences $[\hat{\sigma}^2(1) - \hat{\sigma}^2]$ and $[\hat{\sigma}^2(2) - \hat{\sigma}^2]$ are equal and opposite, the average sum of variance difference is equal to the actual total variance. We also did a simulation with a four equation linear model and found similar results. It should be noted that although we have chosen to work with a three equation linear model for simplicity, the actual model is nonlinear.

In our simulations, (2A.4) does not hold exactly. This can be attributed to the nonlinearity of the model.

2A.2. The Estimation of Stochastic Simulation Error Variances: [METHOD 1, METHOD 2, and METHOD 3]

This section deals with estimating the stochastic simulation error variances (both Bootstrapping and Fair's technique) in order to look at the precision of the estimates C_{it}^g, D_{it}^g and S_{it}^g from the three methods.

Let y^z be the simulated values when all the error terms are drawn,

$y_1^z(g)$ be the simulated values when the error term in the gth equation is fixed at zero (Method 1),

$y_2^z(g)$ be the simulated values when only the error term in the gth equation is

drawn (Method 2).

where z = 1,2,3,....,Z.

Given these values, one could estimate all the variances and, thus, standard errors as follows:

Since all the stochastic simulation estimates C^g, D^g, and S^g involve the base variance $\hat{\sigma}^2$, we will consider first its variance and standard error.

2A.2.1. The Estimation of Stochastic Simulation Error Variance:

(Base Variance $\hat{\sigma}^2$)

Rewriting (2.4.3) in more general notation as

$$\hat{\mu} = \frac{1}{Z}\sum_{z=1}^{Z} y^z \qquad \text{.......(2A.5)}$$

now let

$$\sigma_z^2 = (y^z - \hat{\mu})^2 \qquad \text{(2A.6)}$$

(2.4.4) would then take the following form:

$$\hat{\sigma}^2 = (\frac{1}{Z})\sum_{z=1}^{Z} \sigma_z^2. \qquad \text{(2A.7)}$$

The variance of $\hat{\sigma}^2$ can then be estimated as

$$v\hat{a}r(\hat{\sigma}^2) = (\frac{1}{Z})^2\sum_{z=1}^{Z} (\sigma_z^2 - \hat{\sigma}^2)^2. \qquad \text{(2A.8)}$$

the standard error of $\hat{\sigma}^2$ gives an idea about the precision of its estimate. But since it depends on the units of measurement, we have calculated, in addition to the standard error, a unit-free measure of precision ζ_b as follows:

$$\zeta_b = \frac{\hat{\sigma}^2}{[v\hat{a}r(\hat{\sigma}^2)]^{1/2}} \quad \text{.......... (2A.9)}$$

where subscript "b" represents the base variance.

2A.2.2. The Estimation of Stochastic Simulation Error Variance:

(Variance of $\hat{\delta}_{it}(g)$, METHOD 1)

Let

$$m_z(g) = \sigma_z^2 - \sigma_z^2(g) \quad \text{.......... (2A.10)}$$

σ_z^2 is defined in (2A.6). $\sigma_z^2(g)$ is obtained as:

$$\sigma_z^2(g) = [y_1^z(g) - \hat{\mu}_1]^2$$

where $\hat{\mu}_1 = (\frac{1}{Z})\sum_{z=1}^{Z} y_1^z(g)$

the sample mean of $m_z(g)$, denoted by $\hat{\delta}(g)$, is

$$\hat{\delta}(g) = \left(\frac{1}{Z}\right)\sum_{z=1}^{Z} m_z(g). \qquad \text{(2A.11)}$$

This is the same as (2.4.5) with $\hat{\delta}(g)$ being the difference between the two estimated variances.

The variance of $\hat{\delta}(g)$ can be estimated as

$$v\hat{a}r[\hat{\delta}(g)] = \left(\frac{1}{Z}\right)^2 \sum_{z=1}^{Z} [m_z(g) - \hat{\delta}(g)]^2 \qquad \text{(2A.12)}$$

and the unit-free measure of precision is simply the ratio of

$$\zeta_1 = \frac{\hat{\delta}(g)}{[v\hat{a}r[\hat{\delta}(g)]]^{1/2}} \qquad \text{(2A.13)}$$

where subscript "1" represents METHOD 1.

As mentioned on page 26, the same R's were used for all simulations. The above method of estimating $v\hat{a}r[\hat{\delta}(g)]$ is much smaller than what one would obtained by using different R's for each $\hat{\sigma}^2(g)$, in which case the variance would be $v\hat{a}r[\hat{\delta}(g)] = var(\hat{\sigma}^2) + var[\hat{\sigma}^2(g)]$.

2A.2.3. The Estimation of Stochastic Simulation Error Variance:

(Variance of $\hat{\theta}^2(g)$, METHOD 2)

Consider

$$\mu_2 = (\frac{1}{Z})\sum_{z=1}^{Z} y_2^z(g) \qquad (2A.14)$$

and

$$\theta_z^2(g) = [y_2^z(g) - \hat{\mu}_2]^2 \qquad (2A.15)$$

then

$$\hat{\theta}^2(g) = (\frac{1}{Z})\sum_{z=1}^{Z} \theta_z^2(g). \qquad (2A.16)$$

The variance of $\hat{\theta}^2(g)$ can then be estimated as

$$v\hat{a}r[\hat{\theta}^2(g)] = (\frac{1}{Z})^2 \sum_{z=1}^{Z} [\theta_z^2(g) - \hat{\theta}^2(g)]^2. \qquad (2A.17)$$

and the unit-free measure of precision is simply the ratio of

$$\zeta_2 = \frac{\hat{\theta}^2(g)}{[v\hat{a}r[\hat{\theta}^2(g)]]^{1/2}} \qquad (2A.18)$$

where subscript "2" represents METHOD 2.

2A.2.4. The Estimation of Stochastic Simulation Error Variance:

(Variance of $\hat{\eta}(g)$, METHOD 3)

Consider

$$n_z(g) = [m_z(g) + \theta_z^2(g)]/2 \qquad (2A.19)$$

where $m_z(g)$ is defined in (2A.10) and $\theta_z^2(g)$ is defined in (2A.15).

The estimated mean of $n_z(g)$, denoted by $\hat{\eta}(g)$, is

$$\hat{\eta}(g) = (\frac{1}{Z})\sum_{z=1}^{Z} n_z(g) \qquad (2A.20)$$

The variance of $\hat{\eta}(g)$ can be estimated as

$$v\hat{a}r[\hat{\eta}(g)] = \left(\frac{1}{Z}\right)^2 \sum_{z=1}^{Z} [n_z(g) - \hat{\eta}(g)]^2 \qquad \text{(2A.21)}$$

and the unit-free measure of precision is simply the ratio of

$$\zeta_3 = \frac{\hat{\eta}(g)}{[v\hat{a}r[\hat{\eta}(g)]]^{1/2}} \qquad \text{(2A.22)}$$

where subscript "3" represent METHOD 3.

Chapter 3

THE MODEL

3.1. Introduction

We develop our own macroeconometric model for Canada in this chapter. Although an attempt has been made to make the model as disaggregated as possible, it is still relatively small in comparison to some existing models of the Canadian economy. The existing models are based in some cases on annual and in other cases on quarterly data. They differ also according to the number of equations used. While CANDIDE, for example, is one of the largest models, consisting of over 2000 equations, of which more than 600 are stochastic, the model developed by Chami (1985) consists of only 21 equations, of which 12 are stochastic. The Canadian models were also designed to serve a variety of objectives. SAM, for example, is mainly intended for general medium to longer-term simulation analysis; MACE, on the other hand, is designed for analyzing the linkages between the energy-using and energy-producing sectors of the economy. See Tables 3.1 and 3.2 for a brief tabular presentation of some selected Canadian models.

The model developed here is based on quarterly data and meant for short-run simulation. In its construction, a number of specifications for each equation were experimented with. The final specifications chosen were based not only on good statistical fit but also on theoretical plausibility. Since the performance of the complete model was of main concern, a few of the equations were re-specified after analyzing the performance of the model as a whole in historical simulations.

The next section provides a full description of the model. The last section of the chapter summarizes the discussion, emphasising some of the model's general properties.

3.2. Description of the Model

The basic model consists of 71 equations, 22 stochastic and 49 identities. (For simulation purposes, another eight autoregressive equations are added to determine the exogenous variables.) In order to describe the model equations, we organize them into five blocks: (A) private expenditure components of GDP, (B) public sector, (C) financial sector, (D) prices and income, (E) potential output, unemployment and labour force. The five blocks are interconnected, as shown in Fig 3.1, which displays the block structure of the model.

A. Private expenditure Components of Real GDP

This block involves: (A.1) consumption (CON), (A.2) business gross fixed investment (BGFI), (A.3) business inventories (INV), and (A.4) net exports (X - IM). The equations of the block, along with public inventories (PINV), public gross fixed investment (PGFI), and government current expenditures on goods and services (G) (all of which are treated as exogenous) determine the real gross domestic product (GDP) through the following identity:

$$GDP = CON + TGFI + INV + PINV + G + X - IM \quad \text{.....................................} \quad (3.1)$$

where TGFI is the total gross fixed investment obtained by combining business and public gross fixed investments (TGFI = BGFI + PGFI).

All variables in (3.1) are defined in real terms.

A.1. Consumption

Consumer expenditure on goods and services is disaggregated into four components: durables (CD), non-durables (CND), semi-durables (CSD), and services (CS). The consumption function for each component has the following general specification:

$$CON^i /POP = a^i_1 + a^i_2(PYD/POP) + a^i_3(CON^i /POP)_{-1} + a^i_4(EXINT) \quad \text{......... .... (3.2)}$$

Real expenditure per capita on consumption component i (CON^i /POP) is a function of real personal disposable income per capita (PYD/POP), lagged consumption per capita $(CON^i/POP)_{-1}$, and the expected real interest rate (EXINT), defined as the nominal interest rate (NINT) less the inflation rate (PDOT)[1]. Nominal personal disposable income (NPYD) was deflated by the GDP deflator[2] to obtain real personal disposable income (PYD). NPYD is determined in the model through an identity, NPYD = NPI - NPTX, where NPI is total personal income (nominal) and NPTX is total personal direct tax. The four components are then combined through an identity to determine total consumption expenditure: CON = CD + CND + CSD + CS.

Although the consumption equations have not been derived explicitly from a model of

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[1] We have used the actual year/year inflation rate (current quarter compared with the same quarter in the previous year) as a proxy for the expected inflation rate.

[2] Since we have used only one domestic price deflator to reduce the model complexity, NPYD was deflated by the GDP price deflator instead of a consumer price index.

consumer behaviour they are more or less conventional in form. The inclusion of current income and the lagged dependent variable could represent a permanent income or a habit persistence hypothesis[3] . The presence of the interest rate in all equations provides a link between the financial and the real sectors of the model.

A.2. Business Gross Fixed Investment

Total business gross fixed investment is disaggregated into three components: residential construction (BGFIR), non-residential construction (BGFINR), and machinery and equipment (BGFIME). Residential investment per capita, BGFIR/POP, is assumed to be a function of the expected real interest rate (EXINT), current and lagged output gap (GAP as defined in block (E)), first and second lags of residential investment per capita, and lagged residential capital stock per capita (BKAPR/POP).

$$BGFIR/POP = f[EXINT, GAP, (GAP)_{-1}, (BGFIR/POP)_{-1}, (BGFIR/POP)_{-2}, (BKAPR/POP)_{-1}], \quad \text{.......} \quad (3.3)$$

where f is used as a general functional operator symbol.

Since residential investment is usually thought to be sensitive to interest rates, and responsive to variations in income, the variables EXINT and GAP are included to capture

[3] Evans (1969), p. 24.

those effects.

Non-residential investment as a fraction of lagged non-residential capital stock, $(BGFINR/BKAPNR_{-1})$ is considered to be a function of its own first and second lags and the lagged rate of return on investment (RRI).

$$BGFINR/BKAPNR_{-1} = f[(BGFINR/BKAPNR_{-1})_{-1}, (RRI)_{-1},$$
$$(BGFINR/BKAPNR_{-1})_{-2}] \quad \text{.......} \quad (3.4)$$

RRI is represented by corporate profits (NCPROF) less corporate direct taxes (NCTX), deflated by the GDP price deflator (P), and divided by the lagged real capital stock of non-residential construction and machinery and equipment.

$$RRI = [(NCPROF - NCTX)/P]/[BKAPNR_{-1} + BKAPME_{-1}]$$

Finally, machinery and equipment investment, expressed as a ratio to the lagged machinery and equipment capital stock $(BGFIME/BKAPME_{-1})$, is considered to be a function of first, second and third lags of the dependant variable and the lagged rate of return on investment (RRI).

$$BGFIME/BKAPME_{-1} = f[(BGFIME/BKAPME_{-1})_{-1}, (RRI)_{-1},$$
$$(BGFIME/BKAPME_{-1})_{-2},(BGFIME/BKAPME_{-1})_{-3}] \quad \text{.......} \quad (3.5)$$

Fiscal policy influences these last two components of investment in the model indirectly, through corporate taxes and the rate of return. Monetary policy, on the other hand, is endogenous and is modelled as part of a VAR subsystem (see below); it works more indirectly, through P, which affects RRI, and thus investment.

All three investment components have, as usual, a dual role in the model. In the short run they affect GDP on the expenditure side, while in the long run they represent the accumulation of capital stock, which in turn influences the potential output (PGDP). The capital accumulation process for all three components is represented by the following identity:

$$BKAP^{i} = BGFI^{i}_{-1} + (1 - \delta_{i})\, BKAP^{i}_{-1} \qquad (3.6)$$

Where δ_i is the rate of depreciation for capital of type i. The three components of investment are combined in an identity to determine total business gross fixed investment: BGFI = BGFIR + BGFINR + BGFIME.

A.3. Business Inventories

Business inventory change is broken into two components: non-farm (INVNF) and farm (INVF). While farm inventory change is treated as exogenous in the model, the non-farm component, as a fraction of real gross domestic product (INVNF/GDP), is defined to be a function of the lagged dependant variable, the current output gap (GAP), current and lagged rates of change in expenditures on consumer durables (CDDOT, a proxy for the rate of change in sales), and the rate of change in GDPVDOT, defined as real GDP less business farm and public inventory change [GDPV = GDP - INVF - PINV].

$$INVNF/GDP = f[(INVNF/GDP)_{-1}, CDDOT, (CDDOT)_{-1}, GAP, GDPVDOT] \quad (3.7)$$

The two components are combined through an identity to determine total business inventory change: INV = INVF + INVNF.

A.4. Net Exports

Total exports (X) is taken to be exogenous in the model. However, total imports, as a fraction of real gross domestic product (IM/GDP) is a function of the lagged dependant variable, the current output gap (GAP), and the terms of trade, defined as the ratio of the domestic GDP price deflator (P) to the price of imports index (PIM). The denominator is multiplied by the exchange rate (ER) in order to convert PIM into domestic currency.

$$IM/GDP = f[(IM/GDP)_{-1}, GAP, (P/ER*PIM)] \quad (3.8)$$

B. Public Sector

This block includes six components of the public sector: public real gross fixed investment (PGFI), public real inventory change (PINV), government real current expenditures on goods and services (G), nominal government transfers (NTR), total nominal personal direct tax (NPTX), and total nominal corporate income tax (NCTX). Considering, first, the four expenditure-side components. G, PGFI, and PINV are taken to be exogenous: only government transfers as a fraction of nominal gross domestic product (NTR/NGDP) is endogenous. It is modelled as a function of the lagged dependant variable, the lagged rate of inflation (PDOT), a linear time trend (T), and the unemployment gap (UGAP; see block (E)).

$$NTR/NGDP = f[(NTR/NGDP)_{-1},(PDOT)_{-1},UGAP,T] \quad \text{......} \quad (3.9)$$

We have included stochastic equations for the two revenue-side components. Total personal direct tax as a fraction of total personal income (NPTX/NPI) is taken to be a function of the first, second and third lags of the dependant variable, the unemployment gap (UGAP), and a linear time trend (T).

$$NPTX/NPI = f[(NPTX/NPI)_{-1},(NPTX/NPI)_{-2},(NPTX/NPI)_{-3},UGAP,T] \quad \text{......} \quad (3.10)$$

Total corporate direct tax as a fraction of corporate profits (NCTX/NCPROF) is expressed as a function of the lagged dependant variable, lagged output gap (GAP), and current and lagged ratios of corporate profits to nominal gross domestic product (NCPROF/NGDP).

$$NCTX/NCPROF = f[(NCTX/NCPROF)_{-1},(NCPROF/NGDP),$$
$$(NCPROF/NGDP)_{-1},(GAP)_{1}] \quad \text{.......} \quad (3.11)$$

C. Financial Sector

This block includes the exchange rate (ER), the domestic rate of interest (NINT), the stock of high powered money (HM), the U.S. rate of interest (NINTUS), and the price index for imports (PIM). While NINTUS and PIM are exogenous in the model, the remaining variables are modelled as part of a VAR subsystem. The set of variables in the VAR subsystem includes also the rate of change in the GDP price deflator (PDOT), from block D. The period for which model equations were estimated (see chapter 4) comprises not only two exchange rate regimes, fixed (June 1962 to May 1970) and flexible (June 1970 to date) , but also exhibits some unusual movements in the relevant variables, especially the exchange rate. Following the decision to allow the Canadian dollar to float (June 1, 1970), the dollar rose rapidly (against the U.S. dollar) and reached a peak in the third quarter of 1976; in the following years it fell back to its 1971 level. In the early

1970's monetary policy was influenced by the desire to prevent the Canadian dollar from rising, which lead to an accelerating growth of the money supply. The resulting high inflation rate forced the Bank of Canada to set a target range of growth for the monetary aggregate (M1), in late 1975, in order to reduce the monetary growth gradually and bring down the inflation rate. These attempts of the monetary authorities, not surprisingly, caused interest rates to fall in the early 1970's and to rise in the latter part of the decade.

We tried a number of alternatives to the VAR approach but the performances were poor, and given the inter-relationships among the variables we considered it best to model them as a VAR block.[4] Lagged values of all four dependant variables in this block, the current and lagged U.S. rate of interest (NINTUS), and lagged values of the output gap (GAP) appear as explanatory variables in each equation. (The lags are for one and two periods in all cases.) The PDOT equation includes also lags of the rate of change in nominal wages (WDOT) and the current rate of change in the world oil price (WOPDOT).

D. Prices and Income

This block has a stochastic equation for the rate of change in nominal wages (WDOT) and the rate of change in the GDP price deflator (PDOT). It also includes three stochastic

[4] See Freedman and Longworth (1980) for discussion. They have examined the reasons why empirical models have performed so poorly in explaining the movements in the exchange rate in the 1970's.

equations for labour income (NLI), non-labour income (NNLI) and corporate profits (NCPROF).

While the rate of change in the GDP price deflator (PDOT) is modelled as a part of the VAR subsystem, the rate of change in nominal wages (WDOT) is assumed to be a function of itself lagged one period, the lagged unemployment gap (UGAP), and the lagged rate of change in the GDP price deflator (PDOT). We have also included a dummy variable (AIB) to capture the effects of the Anti Inflation Board wage and price control programs that were in effect from October 1975 to December 1978.

$$WDOT = f[(WDOT)_{-1},(PDOT)_{-1},(UGAP)_{-1},AIB] \quad \text{...} \quad (3.12)$$

The above equation implies a type of Philips curve relating the rate of change in nominal wages to the rate of unemployment.

While total personal income (NPI) is determined in the model through an identity [NPI = NNLI + NLI + NTR], its components, labour income (NLI), non-labour income (NNLI), and transfer payments (NTR), are modelled as stochastic equations. Non-labour income as a fraction of nominal gross domestic product (NNLI/NGDP) is considered to be a function of itself lagged one period, the current output gap, and the ratio of corporate profits to the nominal gross domestic product (NCPROF/NGDP).

$$NNLI/NGDP = f[(NNLI/NGDP)_{-1},\ GAP,\ (NCPROF/NGDP)] \quad \text{.................} \quad (3.13)$$

We computed labour income (NLIN) as 52 times the nominal weekly wage rate (W) times the level of employment (N). An alternative (and preferred) measure of labour income (NLI), as used in the definition of NPI, is obtained from the national income accounts. These two measures are not identical, for various reasons, including the fact that labour income as measured in the national income accounts includes supplementary labour income and a wider range of industries than the other measure. To effect a reconciliation, an adjustment factor is defined as the ratio of the two measures (NLI/NLIN). This factor is then modelled as a function of its own first and second lags, the unemployment gap (UGAP), and a linear time trend (T).

$$NLI/NLIN = f[(NLI/NLIN)_{-1}, (NLI/NLIN)_{-2}, UGAP, T] \quad \ldots\ldots (3.14)$$

Corporate profits as a fraction of nominal gross domestic product (NCPROF/NGDP) is taken to be a function of its own first and second lags and the expected real rate of interest (EXINT).

$$NCPROF/NGDP = f[(NCPROF/NGDP)_{-1}, EXINT, (NCPROF/NGDP)_{-2}] \quad \ldots\ldots (3.15)$$

E. Potential Output, Unemployment and Labour Force

Potential output is generated in the model by introducing a constant-returns-to-scale

Cobb-Douglas production function that captures both short and long-term fluctuations. (See appendix 4B for a detailed explanation of the procedures followed in deriving this function and in using it to generate potential output (PGDP)). The output gap (GAP) is then defined as (GDP - PGDP)/PGDP.

A variation of Okun's law is invoked in the specification of the equation for the rate of unemployment (UNR). This specification relates the unemployment rate to the output gap. It has the following form:

$$\text{Log}(UNR/1\text{-}UNR) - \text{Log}(NUNR/1\text{-}NUNR) = f[(GAP)_{-1}, (\text{Log}(UNR/1\text{-}UNR) - \text{Log}(NUNR/1\text{-}NUNR))_{-1}] \quad (3.16)$$

where NUNR is the natural rate of unemployment[5].

We have generated a series for the full-employment labour force (NSF)[6] and have defined the labour force gap as (NS - NSF)/NSF). The labour force gap is modelled as a function of itself lagged one period and the current unemployment gap, defined as UGAP = UNR - NUNR.

$$(NS - NSF)/NSF = f[((NS - NSF)/NSF)_{-1}, UGAP] \quad (3.17)$$

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[5] See appendix 4B for the derivation of the NUNR series.

[6] See appendix 4B.

The level of employment (N) is determined residually through the identity

$$N = (1 - UNR)NS \qquad (3.18)$$

3.3. Concluding Remarks

Having described the model in detail in the previous section, we conclude this chapter by drawing attention to some of the model's general properties.

In keeping with the Keynesian tradition in macroeconometric modelling, much emphasis has been placed on the determination of the components of final demand. However, the inclusion of a production function and employment, wage and price equations imports to the model some non-Keynesian features as well. The output gap is an important variable in the model and the inclusion of potential output and labour force variables imposes some discipline by introducing supply constraints.

As far as the transmission mechanism for economic policy is concerned, while the effects of fiscal policy on output are more or less direct, monetary policy, though endogenous, and modelled as part of the VAR subsystem, affects output indirectly, through the expected real rate of interest. The way in which labour income is defined provides an important link between the demand and supply sides of the model: any increase in the level of nominal wages, or in the level of employment, raises labour income, which in turn affects GDP through the effects on consumption.

FIG 3.1

BLOCK STRUCTURE OF THE MODEL

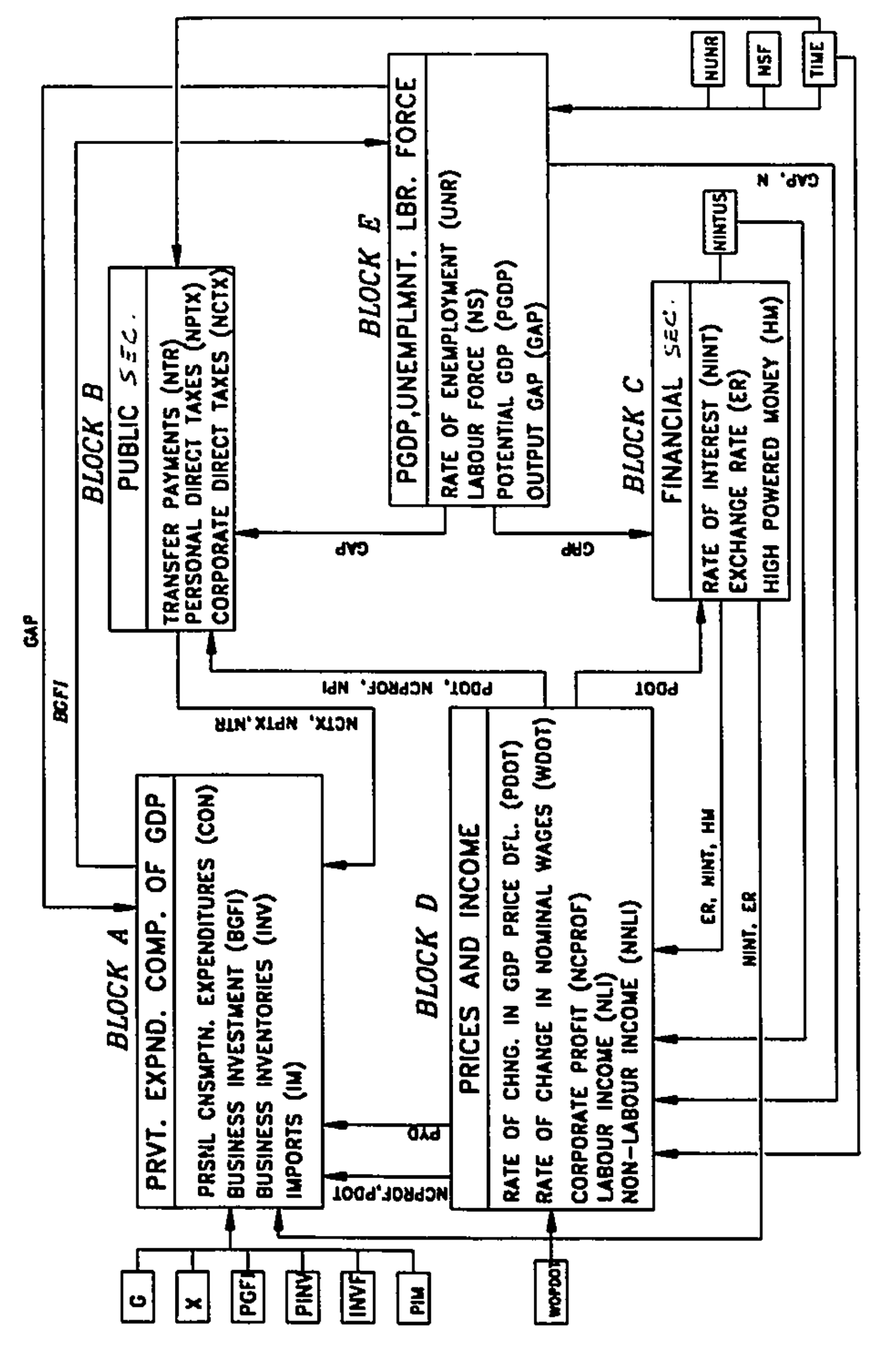

TABLE 3.1

Selected Macroeconometric Models of The Canadian Economy

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1. CANDIDE* (for CANadian Disaggregated Inter-Departmental Econometric) model, developed by the Economic Council of Canada.

2. RDXF* (for Research Department eXperimental Forecasting) model, developed in the Research Department of the Bank of Canada.

3. MACE* (for MACro and Energy) model, developed by John Helliwell and Associates at the University of British Columbia.

4. TRACE* (for ToRonto Annual Canadian Econometric) model, developed at the Institute for Policy Analysis, University of Toronto.

5. MTFM* (for Medium-Term Forecasting Model) model, developed by the Conference Board of Canada.

6. SAM** (for Small Annual Model) model, developed in the Research Department of the Bank of Canada.

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* The versions referred to are discussed in Bodkin et al. (1991).

** The version referred to is reported in Rose and Selody (1985).

TABLE 3.2

Major Characteristics of the Selected Macroeconometric Models of The Canadian Economy

Model	Type	Size	Use
CANDIDE	Annual	Large over 2000 equations	Medium and long-term forecasting, generating alternative forecast scenarios, fiscal and monetary policy analysis.
TRACE	Annual	Medium over 180 equations	Short and medium-term policy analysis.
MACE	Annual	Large over 600 equations	To analyze the linkages between the energy-using and energy-producing sectors of the economy.
RDXF	Quarterly	Large over 400 equations	To produce the Bank of Canada's regular quarterly short and medium-term forecasts.
MTFM	Quarterly	Large over 800 equations	Short and medium-term forecasting.
SAM	Annual	Small 103 equations	Medium to long-term simulation analysis.

Chapter 4

MODEL ESTIMATION

AND

HISTORICAL SIMULATION

In this chapter, we describe, first, how the equations of the model were estimated, and second, how dynamic and static simulations were carried out to check the model's ability to replicate historical time series.

4.1. Model Estimation

4.1.1. Estimation Technique

All model equations were estimated through 1988 quarter four, using seasonally adjusted quarterly time series data. The beginning period of estimation is 1962 quarter four for all of the model equations except those of the financial sector, which were estimated for the period 1970:4 to 1988:4 as a VAR block[1]. Initially, all equations were estimated by Ordinary Least Squares (OLS). Since the assumption of zero correlation between the right-hand-side variables and the error terms are often violated in simultaneous-equation models, it is well known that OLS estimators are inconsistent in such cases. An alternative estimation technique is Two-Stage Least Squares (2SLS). This method can be thought of as consisting of two separate stages. The first involves regressing each right-hand-side endogenous variable on the predetermined variables of the model; the second stage involves an OLS regression performed with the right-hand-side endogenous variables replaced by their first-stage estimated values. If the number of predetermined variables of the model exceeds the sample size, the first stage of the 2SLS method breaks down. Although in our model this was not the case, the number of degrees of freedom in the first stage would have been reduced considerably if all of the

[1] The reasons for estimating the VAR equations over the shorter period are provided below.

predetermined variables had been used. (See Johnston, 1970, for a discussion of this type of problem.) This difficulty can be dealt with by replacing the predetermined variables by a small set of principal components. Kloek and Mennes (1960) have proposed different methods of selecting the principal components (PCs) of the predetermined variables of the model. The method we employed requires selecting a single subset of PCs from the complete set of all the predetermined variables in the model. We computed sets of six, nine, and sixteen PCs accounting for 90, 95, and 99 percent, respectively, of the total variation among the predetermined variables. Each of the first-stage equations was then calculated three times (by OLS), using each of the PC subset in turn, and including also as regressors any predetermined variables appearing in the equation. On the basis of F-tests, the sixteen-PCs option was selected. Ten of the 22 behavioral equations were estimated by this method (see table 4.2). Four equations (EQ6,EQ7,EQ14,EQ15) were estimated by OLS, since all the right-hand-side variables were predetermined. Four of the remaining eight equations (EQ19,EQ20,EQ21,EQ22) were estimated as a VAR block, while the other four (EQ1,EQ2,EQ3,EQ4) were estimated as a SURE (seemingly unrelated regression equations) system using the same sixteen PCs. The estimation of these eight equations requires separate discussion[2].

[2] We also estimated eight autoregressive (AR) equations for exogenous variables by OLS, over a sample period of 1962:4 to 1988:4, for use in the stochastic simulations. See Table 4.4.

Estimation of the VAR Block (VAR-SURE)

This VAR block consists of four financial-sector, equations. If all equations in the VAR system have the same right-hand-side variables, estimating each one separately by OLS provides efficient estimates. In our case, however, one equation (EQ22) has a few additional explanatory variables. Therefore, we estimated all four equations as a SURE system, since that produces some gain in efficiency as compared to the OLS method. Initially, this block was estimated over a longer period, i.e., 1962-4 to 1988-4, which includes both of the exchange rate regimes, fixed and flexible. We also tried estimating this block over the shorter period, 1970-4 to 1988-4, corresponding to the flexible exchange rate regime. For simulation purposes we chose to work with the VAR block, estimated over a shorter period simply because it correspond to single exchange rate regime, flexible.

Estimation of the Consumption Equations (SURE-PC)

All four consumption equations were estimated initially by OLS, using data from 1962-2 to 1988-4. The combined long-run marginal propensity to consume (CLRMPC) turned out to be greater than one, so we re-estimated the equations as a SURE-PC[3] system and

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[3] A set of sixteen PCs were used as instruments, in addition to the predetermined variables of the system.

tested the null hypothesis that the coefficients of all lagged dependent variables are the same. (The SURE-PC procedure is equivalent to a modified form of Three-Stage Least Squares.) The hypothesis was not rejected even at the 10% significance level[4]. But since the CLRMPC[5] was still greater than one, the four equations were re-estimated again as a SURE-PC system, restricting the coefficients of the lagged dependent variables to be equal and the CLRMPC to be a fixed value less than one. We experimented with restrictions in the range 0.35 to 0.98, and in the end chose 0.9, a compromise between the unrestricted choice (>1) and the average actual ratio of consumption to income over the sample period (0.85).

4.1.2. Summary of the Estimation Results

This section discusses briefly the estimated form of the model. The variables of the model are defined in Table 4.1 and the estimated equations and identities are presented in Tables 4.2 and 4.3 respectively. The method and period of estimation is stated in Table

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[4] The test and the critical values for the F - statistic, with 3 and 408 degrees of freedom, were: test value = 1.29, critical value = 2.08. For the same level of significance, $\chi^2_{.05,3}$ = 3.87 (test value), 6.25 (critical value).

[5] The following formula was used to compute the CLRMPC.

$$CLRMPC = \frac{\sum_{i=1}^{4} a_2^{\,i}}{(1 - a_3)} .$$

4.2 for each equation. The t statistic is given in brackets under each coefficients and beneath each equation are the adjusted R-squared statistic $(\bar{R}^2)$, the standard error of regression (S.E), and an estimate of the first-order autocorrelation parameter $\hat{\rho}$.[6] On the whole, the empirical results for the model seem satisfactory. Most of the parameters have the expected signs, although their significance varies over a wide range.[7]

In all four estimated consumption equations (EQ1 to EQ4), the positive relation with real disposable income (NPYD/P) is significant. While the expected real rate of interest, EXINT (the cost of borrowing), has, as expected, a negative sign in all four equations, it is less significant in the equations for durables (CD/POP) and services (CS/POP).

Gross fixed investment in residential construction (EQ5) depends significantly not only on its own past behaviour but also on the expected real rate of interest, current and lagged output gaps, and the lagged residential capital stock. While the real rate of interest has a negative impact, the combined output gap has a positive effect on residential investment. Gross fixed investment in non-residential construction and machinery and equipment (EQ6, EQ7) depend largely (through the autoregressive terms) on their

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[6] The autocorelation parameter is estimated by $\hat{\rho} = (1 - \frac{1}{2} DW)$, where DW is the Durbin-Watson statistic.

[7] Note that the t statistics for the 2SLS-PC and SURE-PC coefficients do not have student's t distribution. Tests based on them should therefore be regarded with some caution. The same is true for the OLS coefficients when an equation has a lagged dependent variable.

previous time paths. In addition, the rate of return (RRI) has a positive effect in each of these equations, the effect being more significant in EQ6 than in EQ7.

As usual, it is hard to get a good fit for inventory investment: the non-farm inventory equation (EQ8) does not fit well. Lagged inventory investment and GDPVDOT are the most important explanatory variables.

The unemployment gap (UGAP), the rate of inflation (PDOT), the time trend and the previous behaviour of government transfers (NTR) are the most significant factors influencing current government transfer payments (EQ10). The two government tax revenue variables (EQ11, EQ13) are determined mainly by their own past behaviour. The unemployment gap is important in determining the labour force gap (EQ13), and the lagged output gap is significant in determining the change in the unemployment gap (EQ14).

In the wage equation (EQ15), the dummy variable for the Anti Inflation Board (AIB) does have a negative coefficient, as expected, but the coefficient is not significant. All other variables in the equation are statistically significant. The large coefficient of the lagged rate of change of wages indicates some rigidity in wage change.

Non-labour income and corporate profits are determined mainly by their own past behaviour. Finally, the VAR block equations show the U.S. rate of interest to be important; it enters significantly in all of the VAR equations. The change in world oil price significantly affects the domestic rate of inflation (EQ22).

4.2. Historical Simulation

In the preceding section, the individual equations were evaluated on the basis of goodness-of-fit statistics, and by examining the signs and magnitudes of the estimated coefficients. The evaluation of the performance of the complete model is more complicated; good performance of the individual equations does not necessarily imply that the model as a whole will also perform well. It may be the case that an equation with poor statistical fit performs quite well as part of a complete model, and the reverse may also be true. A criterion commonly used to evaluate a complete model is the fit of the individual variables in a simulation context[8]. There are various types of simulations that can be performed, depending on the objective of the analysis. Historical simulations are usually conducted to test the validity and realism of a model by examining how closely it tracks the actual time paths of the endogenous variables. Although a simple plot of actual and simulated series would give an idea about the tracking, it may also be desirable to have some quantitative measures.

In order to check the models ability to replicate historical time series, two types of historical simulations[9], static and dynamic, were carried out over the sample period 1970:4 - 1988:4. In static simulation, the endogenous variables are predicted one period

[8] The discussion of the evaluation of a complete model is based, in part, on chapter 12 of Pindyck and Rubinfield (1991).

[9] We used RATS, version 4.01 to perform these simulations. The procedures FORECAST for dynamic and STEPS for static simulations were used.

at a time, with all predetermined variables taking on their actual values. In dynamic simulation, on the other hand, the values of lagged endogenous variables for the first period are the observed values but for all subsequent periods they are the values simulated by the model for the previous period. While static simulation may be useful in examining the ability of the model to match the behaviour of the endogenous variables in the short run, dynamic simulation provides a more informative test of the dynamic structure of the model and of the feedbacks within the system. Therefore, actual and simulated values for selected endogenous variables are plotted in Figures 4.1 to 4.22 for the dynamic simulations only. In addition, root-mean-square errors (RMS), root-mean-square-percentage errors (RMSP), and Theil's inequality coefficients (U) are reported for the same selected endogenous variables along with their mean values, in table 4.5. The RMS, RMSP and U statistics for a variable Y are defined as follows:

$$RMS = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(Y_t^s - Y_t^a)^2} \quad \text{.. (4.2.1)}$$

$$RMSP = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\frac{Y_t^s - Y_t^a}{Y_t^a}\right)^2} \quad \text{.. (4.2.2)}$$

and

$$U = \sqrt{\frac{\sum[(Y_{t-1}^s - Y_t^s) - (Y_{t-1}^a - Y_t^a)]^2}{\sum(Y_{t-1}^a - Y_t^a)^2}} \quad \text{.. (4.2.3)}$$

where Y_t^s = simulated value of Y_t

Y_t^a = actual value

T = number of periods in the simulation

RMSP[10] is perhaps a better measure than RMS, since it does not require a comparison with the average size of the variable in question. Theil'U, a unit-free measure, is defined so that it always lies between 0 and ∞ . A zero value of U implies a perfect fit, i.e.

$(Y_{t-1}^s - Y_t^s) = (Y_{t-1}^a - Y_t^a)$ for all t. A value 1, on the other hand, indicates the predictive performance of the model to be no better than that of "naive" or "no change" prediction.

The results show the tracking ability of the model, though not perfect, to be satisfactory for our purposes. Theil's U is greater than 1 for a few of the endogenous variables, but the RMSP simulation errors are generally not very large. Of the 22 endogenous variables reported in Table 4.5, 13 have RMSP simulation errors of less than 10% and only 3 have values greater than 40%. INVNFGP (non-farm business inventory change) is the only real variable reported that has a very large simulation error, which is perhaps not surprising, given the rather poor fit of its equation and the volatile nature of the series.

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[10] Note that the RMSP is not a good measure for a series such as inventory change, which can be positive, negative, or zero. RMS is better in this case.

The historical simulation results can be analyzed more fully by examining the plots of the endogenous variables in Figures 4.1 to 4.22. Looking at those, one can observe that the simulated series do seem to reproduce the general behaviour of the actual series, although short-run fluctuations are not reproduced well in some cases, and some of the turning points are missed altogether. (For example, the model fails to reproduce the sharp increase in the rate of unemployment (UNR) that occurred in the early 1980's.) The VAR block equations perform very well and reproduce almost all turning points. Simulated real GDP follows rather closely its historical values, but some turning points are missed for some of its components (especially nonfarm inventory change and the fixed investment variables).

It should be noted that dynamic simulation over a period of several years represents a rather stringent test of the model, from the point of view of the present study. For the stochastic simulations to follow the periods of interest range from one quarter to only eight quarters.

TABLE 4.1

Variables of the Model

Endogenous Variables

BGFI	Total business gross fixed investment.
BGFIME	Business gross fixed investment, machinery and equipment.
BGFINR	Business gross fixed investment, non-residential construction.
BGFIR	Business gross fixed investment, residential construction.
BGFIRP	See IDEN44, Table 4.3.
BGFKME	See IDEN37, Table 4.3.
BGFKNR	See IDEN38, Table 4.3.
BKAP	Total business capital stock, obtained by summing three components: BKAP = BKAPR + BKAPNR + BKAPME.
BKAPME	Business capital stock, machinery and equipment.
BKAPNR	Business capital stock, non-residential construction.
BKAPR	Business capital stock, residential construction.
BKRP	See IDEN40, TABLE 4.3.
CD	Consumer expenditure on durable goods.

......Continued Table 4.1

CDDOT[a]	Rate of change in CD.
CDP	See IDEN45, Table 4.3.
CND	Consumer expenditure on non-durable goods.
CNDP	See IDEN46, Table 4.3.
CON	Total consumption expenditure.
CS	Consumer expenditures on services.
CSD	Consumer expenditure on semi-durable goods.
CSDP	See IDEN47, Table 4.3.
CSP	See IDEN48, Table 4.3.
ER	Exchange rate, nominal (price of U.S. dollar in terms of Canadian dollar.)
EXINT	Expected real rate of interest. See IDEN5, Table 4.3.
GAP[b]	Output gap.
GDP	Gross domestic product.
GDPV	Defined as GDP less value of physical changes in business farm and public inventories. See IDEN17, Table 4.3.
GDPVDOT[a]	Rate of change in GDPV.
HM	High powered money, nominal, obtained by adding currency outside chartered banks & Bank of Canada notes held by chartered banks and deposits of chartered banks at the Bank of Canada.
HMGP	See IDEN49, Table 4.3.

.....Continued Table 4.1

IM	Total imports.
IMGP	See IDEN34, Table 4.3.
INV	Total value of physical changes in business inventories.
INVNF	Total value of physical changes in business non-farm inventories.
INVNFGP	See IDEN36, Table 4.3.
LUNRND	defined as log[UNR/(1 - UNR)] - log[NUNR/(1 - NUNR)]
LUNRR	See IDEN42, Table 4.3.
N	Employment, 15 years and over, both sexes.
NCPFGP	See IDEN28, Table 4.3.
NCPROF	Total corporate profits (before taxes), nominal.
NCTX	Total corporate direct taxes, nominal.
NCXPF	See IDEN31, Table 4.3.
NGDP	Gross domestic product, nominal.
NILN	See IDEN29, Table 4.3.
NINT	Interest rate (three month treasury bills), nominal.
NLI	Labour income, nominal.
NLIN	Labour income, defined as 52xWxN.
NNLI	Non labour income (excluding transfer payments), nominal.
NNLIGP	See IDEN27, Table 4.3.

......Continued Table 4.1

NPI	Personal income, nominal.
NPTX	Total personal direct tax revenue, nominal.
NPYD	Personal disposable income, nominal.
NS	Labour force, 15 years and over, both sexes.
NSGAP[b]	Labour force gap.
NTR	Total transfer payments, nominal.
NTRGP	See IDEN33, Table 4.3.
NTXPI	See IDEN32, Table 4.3.
P	GDP price deflator.
PDOT[c]	Rate of change in GDP price deflator.
PGDP	Potential GDP.
PYD	Personal disposable income.
PYDP	See IDEN26.
RRI	Rate of return on investment. See IDEN14, Table 4.3.
TGFI	Total gross fixed investment.
TKAP	Total capital stock, obtained by adding total business and public capital stocks.
TOT	Terms of trade. See IDEN35, Table 4.3.
UGAP[d]	Unemployment gap.

......Continued Table 4.1

UNR	Rate of unemployment, 15 years and over, both sexes.
UNRR	See IDEN42, Table 4.3.
W	Average weekly wages (industrial composite), nominal.
WDOT^e	Rate of change in nominal wages.

Exogenous Variables:

WOPDOT^e	Rate of change in world oil price index.
X	Total exports.
G	Govt current expenditures on goods and services.
NINTUS	U.S. interest rate, nominal.
NS^F	Full-employment labour force.
NUNR	Natural rate of unemployment.
PGFI	Total public gross fixed investment.
PIM	Implicit import price deflator.
PINV	Total value of physical change in public inventories.
PKAP	Total public capital stock, obtained by adding three components: PKAP = PKAPR + PKAPNR + PKAPME.
POP	Total Population.
T	Time trend (T = 1,2,....)

......Continued Table 4.1

TM	Trend minus its mean.
AIB	Dummy variable for Anti Inflation Board wage and price control programs that were in effect from Oct. 1975 to Dec. 1978.
LUNRN	Defined as log[NUNR/(1 - NUNR)]

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a For variable z, DOT stands for $(z - z_{-1})/z_{-1}$.

b For variable z, GAP stands for $(z - z^*)/z^*$, where z^* is a potential or full-employment level of z.

c For variable z, DOT stands for $(z - z_{-4})/z_{-4}$.

d For variable z, GAP stands for $(z - z^*)$, where z^* is a potential or full-employment level of z.

TABLE 4.2

Equations of the Model

EQ1. SURE-PC, 62:4 - 88:4

CD/POP = -47.24 + 0.015(NPYD/P) - 175(EXINT) +
(-2.56) (3.79) (-1.60)

0.934(CD/POP)$_{-1}$
(57.97)

R^2 = 0.991 S.E. = 33.61 $\hat{\rho}$ = -0.003

EQ2. SURE-PC, 62:4 - 88:4

CND/POP = 94.70 + 0.008(NPYD/P) - 238(EXINT) +
(5.13) (2.77) (-2.51)

0.934(CND/POP)$_{-1}$
(57.97)

R^2 = 0.990 S.E. = 24.15 $\hat{\rho}$ = -0.214

EQ3. SURE-PC, 62:4 - 88:4

CSD/POP = -1.92 + 0.007(NPYD/P) - 110(EXINT) +
(-0.43) (3.97) (-2.98)

0.934(CSD/POP)$_{-1}$
(57.97)

R^2 = 0.996 S.E. = 10.96 $\hat{\rho}$ = -0.077

...... Continued Table 4.2

EQ4. SURE-PC, 62:4 - 88:4

CS/POP = -11.95 + 0.03(NPYD/P) - 79.34(EXINT) +
(-1.33) (4.48) (-1.18)

$0.934(CS/POP)_{-1}$
(57.97)

R^2 = 0.999   S.E. = 20.61 $\hat{\rho}$ = 0.059

EQ5. 2SLS-PC, 62:4 - 88:4

BGFIR/POP = -5.49 - 285(EXINT) + 1548(GAP) - $1237(GAP)_{-1}$
(-0.43) (-2.61) (3.11) (-2.69)

+ $1.06(BGFIR/POP)_{-1}$ - $0.27(BGFIR/POP)_{-2}$ +
(10.8) (-2.88)

$0.017(BKAPR/POP)_{-1}$
(3.52)

$\bar{R}^2$ = 0.979   S.E. = 26.80 $\hat{\rho}$ = -0.003

EQ6. OLS, 62:4 - 88:4

$BFGINR/BKAPNR_{-1}$ = 0.001 + $1.23[BGFINR/BKAPNR_{-1}]_{-1}$ +
(0.63) (12.97)

$0.078(RRI)_{-1}$ - $0.302[BGFINR/BKAPNR_{-1}]_{-2}$
(3.64) (-3.33)

$\bar{R}^2$ = 0.967   S.E. = 0.002 $\hat{\rho}$ = 0.002

...... Continued Table 4.2

EQ7. OLS, 62:4 - 88:4

$$BGFIME/BKAPME_{-1} = \underset{(2.17)}{0.01} + \underset{(11.77)}{1.17}[BGFIME/BKAPME_{-1}]_{-1} +$$

$$\underset{(1.73)}{0.079}(RRI)_{-1} -$$

$$\underset{(-0.53)}{0.081}[BGFIME/BKAPME_{-1}]_{-2} - \underset{(-1.89)}{0.191}[BGFIME/BKAPME_{-1}]_{-3}$$

$\bar{R}^2 = 0.906$ S.E. = 0.006 $\hat{\rho} = -0.009$

EQ8. 2SLS-PC, 62:4 - 88:4

$$INVNF/GDP = - \underset{(-1.31)}{0.003} + \underset{(6.66)}{0.586}(INVNF/GDP)_{-1} - \underset{(-1.60)}{0.092}(CDDOT)$$

$$+ \underset{(0.30)}{0.008}(CDDOT)_{-1} + \underset{(2.83)}{0.666}(GDPVDOT) + \underset{(1.57)}{0.048}(GAP)$$

$\bar{R}^2 = 0.648$ S.E. = 0.007 $\hat{\rho} = -0.159$

EQ9. 2SLS-PC, 62:4 - 88:4

$$IM/GDP = \underset{(-1.46)}{-0.012} + \underset{(30.32)}{0.97}(IM/GDP)_{-1} + \underset{(0.88)}{0.019}(GAP) +$$

$$\underset{(1.59)}{0.022}(P/ER*PIM)$$

$\bar{R}^2 = 0.979$ S.E. = 0.007 $\hat{\rho} = 0.052$

EQ10. 2SLS-PC, 62:4 - 88:4

...... Continued Table 4.2

$$NTR/NGDP = \underset{(4.30)}{0.015} + \underset{(13.25)}{0.76}(NTR/NGDP)_{-1} + \underset{(2.17)}{0.016}(PDOT)_{-1}$$

$$+ \underset{(3.90)}{0.104}(UGAP) + \underset{(3.37)}{0.00011}(T)$$

$\bar{R}^2$ = 0.988 S.E. = 0.0024 $\hat{\rho}$ = 0.025

<u>EQ11. 2SLS-PC, 62:4 - 88:4</u>

$$NPTX/NPI = \underset{(2.14)}{0.011} + \underset{(4.38)}{0.43}(NPTX/NPI)_{-1} + \underset{(2.61)}{0.27}(NPTX/NPI)_{-2}$$

$$+ \underset{(2.14)}{0.21}(NPTX/NPI)_{-3} - \underset{(-1.77)}{0.09}(UGAP) + \underset{(1.84)}{0.0001}(T)$$

$\bar{R}^2$ = 0.956 S.E. = 0.007 $\hat{\rho}$ = -0.023

<u>EQ12. 2SLS-PC, 62:4 - 88:4</u>

$$NCTX/NCPROF = \underset{(1.09)}{0.035} + \underset{(16.43)}{0.91}(NCTX/NCPROF)_{-1} + \underset{(0.64)}{0.03}(GAP)_{-1}$$

$$- \underset{(-1.87)}{0.77}(NCPROF/NGDP) + \underset{(1.84)}{0.73}(NCPROF/NGDP)_{-1}$$

$\bar{R}^2$ = 0.790 S.E. = 0.017 $\hat{\rho}$ = 0.137

<u>EQ13. 2SLS-PC, 62:4 - 88:4</u>

$$(NS - NSF)/NSF = - \underset{(-4.24)}{0.163}(UGAP) + \underset{(10.53)}{0.68}[(NS-NSF)/NSF]_{-1}$$

$\bar{R}^2$ = 0.851 S.E. = 0.004 $\hat{\rho}$ = 0.062

...... Continued Table 4.2

EQ14. OLS, 62:4 - 88:4

$$[\text{Log}(UNR/1\text{-}UNR) - \log(NUNR/1\text{-}NUNR)] = \underset{(-3.18)}{- 0.909}(GAP)_{-1}$$

$$+ \underset{(25.36)}{0.89}[\log(UNR/1\text{-}UNR) - \log(NUNR/1\text{-}NUNR)]_{-1}$$

$\bar{R}^2$ = 0.963 S.E. = 0.056 $\hat{\rho}$ = 0.422

EQ15. OLS, 62:4 - 88:4

$$WDOT = \underset{(1.83)}{0.003} + \underset{(22.90)}{0.824}(WDOT)_{-1} - \underset{(-4.17)}{0.148}(UGAP)_{-1} + \underset{(5.41)}{0.17}(PDOT)_{-1}$$

$$- \underset{(-1.08)}{0.0023}(AIB)$$

$\bar{R}^2$ = 0.956 S.E. = 0.007 $\hat{\rho}$ = 0.080

EQ16. 2SLS-PC, 62:4 - 88:4

$$NLI/NLIN = \underset{(3.72)}{0.170} + \underset{(6.66)}{0.65}(NLI/NLIN)_{-1} + \underset{(1.81)}{0.17}(NLI/NLIN)_{-2}$$

$$- \underset{(-3.83)}{0.32}(UGAP) + \underset{(4.13)}{0.0004}(T)$$

$\bar{R}^2$ = 0.953 S.E. = 0.009 $\hat{\rho}$ = -0.042

EQ17. 2SLS-PC, 62:4 - 88:4

$$NNLI/NGDP = \underset{(0.74)}{0.005} + \underset{(31.50)}{0.96}(NNLI/NGDP)_{-1} - \underset{(-1.45)}{0.02}(GAP)$$

...... Continued Table 4.2

$$+ \underset{(0.69)}{0.024}(NCPROF/NGDP)$$

$\bar{R}^2$ = 0.939   S.E. = 0.004 $\hat{\rho}$ = 0.078

<u>EQ18. 2SLS-PC, 62:4 - 88:4</u>

$$NCPROF/NGDP = \underset{(3.79)}{0.017} + \underset{(11.82)}{1.11}(NCPROF/NGDP)_{-1} -$$

$$\underset{(-2.89)}{0.27}(NCPROF/NGDP)_{-2} - \underset{(-2.82)}{0.049}(EXINT)$$

$\bar{R}^2$ = 0.856   S.E. = 0.005 $\hat{\rho}$ = -0.061

<u>EQ19. VAR-SURE, 70:4 - 88:4</u>

$$ER = \underset{(1.89)}{0.142} + \underset{(12.11)}{1.29}(ER)_{-1} - \underset{(-3.54)}{0.391}(ER)_{-2} - \underset{(-0.79)}{0.212}(PDOT)_{-1}$$

$$+ \underset{(0.17)}{0.043}(PDOT)_{-2} + \underset{(0.75)}{2.49}(HMGP)_{-1} - \underset{(-0.95)}{3.21}(HMGP)_{-2}$$

$$+ \underset{(0.15)}{0.037}(NINT)_{-1} + \underset{(0.38)}{0.09}(NINT)_{-2} - \underset{(-0.89)}{0.25}(GAP)_{-1}$$

$$+ \underset{(0.63)}{0.18}(GAP)_{-2} + \underset{(2.10)}{0.40}(NINTUS) - \underset{(-0.35)}{0.13}(NINTUS)_{-1}$$

$$- \underset{(-0.54)}{0.15}(NINTUS)_{-2}$$

$\bar{R}^2$ = 0.98   S.E = 0.016 $\hat{\rho}$ = -0.047

<u>EQ20. VAR-SURE, 70:4 - 88:4</u>

...... Continued Table 4.2

$$NINT = -\underset{(-0.01)}{0.0004} - \underset{(-0.93)}{0.044}(ER)_{-1} + \underset{(1.06)}{0.05}(ER)_{-2}$$

$$- \underset{(-0.34)}{0.04}(PDOT)_{-1} + \underset{(0.81)}{0.09}(PDOT)_{-2} - \underset{(-0.04)}{0.06}(HMGP)_{-1}$$

$$- \underset{(-0.10)}{0.15}(HMGP)_{-2} + \underset{(7.38)}{0.79}(NINT)_{-1} + \underset{(0.36)}{0.04}(NINT)_{-2}$$

$$+ \underset{(0.52)}{0.06}(GAP)_{-1} - \underset{(-0.25)}{0.03}(GAP)_{-2} + \underset{(8.97)}{0.76}(NINTUS)$$

$$- \underset{(-1.21)}{0.19}(NINTUS)_{-1} - \underset{(-3.11)}{0.38}(NINTUS)_{-2}$$

$\bar{R}^2 = 0.961$ S.E $= 0.007$ $\hat{\rho} = 0.058$

<u>EQ21. VAR-SURE, 70:4 - 88:4</u>

$$HMGP = \underset{(0.96)}{0.003} - \underset{(-0.24)}{0.001}(ER)_{-1} - \underset{(-0.08)}{0.0004}(ER)_{-2}$$

$$- \underset{(-2.70)}{0.03}(PDOT)_{-1} + \underset{(1.83)}{0.019}(PDOT)_{-2} + \underset{(4.51)}{0.63}(HMGP)_{-1}$$

$$+ \underset{(2.52)}{0.36}(HMGP)_{-2} - \underset{(-2.20)}{0.02}(NINT)_{-1} + \underset{(1.88)}{0.019}(NINT)_{-2}$$

$$- \underset{(-0.99)}{0.01}(GAP)_{-1} + \underset{(2.15)}{0.03}(GAP)_{-2} - \underset{(-3.01)}{0.02}(NINTUS)$$

$$+ \underset{(1.85)}{0.03}(NINTUS)_{-1} + \underset{(0.17)}{0.002}(NINTUS)_{-2}$$

$\bar{R}^2 = 0.992$ S.E $= 0.0007$ $\hat{\rho} = 0.031$

...... Continued Table 4.2

EQ22. VAR-SURE, 70:4 - 88:4

$$PDOT = \underset{(-3.47)}{-0.13} + \underset{(0.30)}{0.02}(ER)_{-1} + \underset{(1.04)}{0.05}(ER)_{-2}$$

$$+ \underset{(5.85)}{0.81}(PDOT)_{-1} + \underset{(0.14)}{0.02}(PDOT)_{-2} + \underset{(0.08)}{0.12}(HMGP)_{-1}$$

$$+ \underset{(0.81)}{1.31}(HMGP)_{-2} + \underset{(0.81)}{0.10}(NINT)_{-1} - \underset{(-2.03)}{0.23}(NINT)_{-2}$$

$$+ \underset{(0.65)}{0.08}(GAP)_{-1} + \underset{(0.38)}{0.05}(GAP)_{-2} + \underset{(1.73)}{0.16}(NINTUS)$$

$$- \underset{(-1.09)}{0.19}(NINTUS)_{-1} + \underset{(1.78)}{0.24}(NINTUS)_{-2} - \underset{(-0.86)}{0.10}(WDOT)_{-1}$$

$$+ \underset{(0.98)}{0.11}(WDOT)_{-2} + \underset{(1.95)}{0.006}(WOPDOT)$$

$\bar{R}^2 = 0.962$ S.E $= 0.008$ $\hat{\rho} = 0.048$

TABLE 4.3

Model Identities

IDEN1*	GDP	=	CON + TGFI + INV + PINV + G + X - IM
IDEN2*	CON	=	CD + CND + CSD + CS
IDEN3	P	=	P_{-4}x(1 + PDOT)
IDEN4	W	=	W_{-4}x(1 + WDOT)
IDEN5	EXINT	=	NINT - PDOT
IDEN6	NGDP	=	P*GDP
IDEN7*	TGFI	=	BGFI + PGFI
IDEN8*	TKAP	=	BKAP + PKAP
IDEN9*	BGFI	=	BGFIR + BGFINR + BGFIME
IDEN10*	BKAP	=	BKAPR + BKAPNR + BKAPME
IDEN11	BKAPR	=	$BGFIR_{-1}$/4 + (1 - 0.0063)x$BKAPR_{-1}$
IDEN12	BKAPNR	=	$BGFINR_{-1}$/4 + (1 - 0.0075)x$BKAPNR_{-1}$

...... Continued Table 4.3

IDEN13	BKAPME	=	$BGFIME_{-1}/4 + (1 - 0.0213)xBKAPME_{-1}$
IDEN14	RRI	=	$((NCPROF - NCTX)/P)/(BKAPNR_{-1} + BKAPME_{-1})$
IDEN15	INV	=	INVNF + INVF
IDEN16	CDDOT	=	$(CD - CD_{-1})/CD_{-1}$
IDEN17	GDPV	=	GDP - INVF - PINV
IDEN18	GDPVDOT	=	$(GDPV - GDPV_{-1})/GDPV_{-1}$
IDEN19	NPI	=	NLI + NNLI + NTR
IDEN20*	NPYD	=	NPI - NPTX
IDEN21	NLIN	=	52xWxN
IDEN22	PGDP	=	$e^{6.97}(TKAP)^{.30}[(1 - NUNR)NSF]^{.70} e^{0.0024*TM} e^{0.000018*TM^2}$
IDEN23	GAP	=	(GDP - PGDP)/PGDP
IDEN24	UGAP	=	UNR - NUNR
IDEN25	N	=	(1 - UNR)xNS
IDEN26	PYDP	=	PYD/POP
IDEN27	NNLI	=	NNLIGPxNGDP

...... Continued Table 4.3

IDEN28	NCPROF	=	NCPFGPxNGDP
IDEN29	NLI	=	NILNxNLIN
IDEN30*	NS	=	NSFx(1 + NSGAP)
IDEN31	NCTX	=	NCXPFxNCPROF
IDEN32	NPTX	=	NTXPIxNPI
IDEN33	NTR	=	NTRGPxNGDP
IDEN34	IMGP	=	IMxGDP
IDEN35	TOT	=	P/(ERxPIM)
IDEN36	INVNF	=	INVNFGPxGDP
IDEN37	BGFIME	=	BGFKMExBKAPME$_{-1}$
IDEN38	BGFINR	=	BGFKNRxBKAPNR$_{-1}$
IDEN39	PYD	=	NPYD/P
IDEN40	BKRP	=	BKAPR/POP
IDEN41	UNR	=	UNRR/(1 + UNRR)
IDEN42	UNRR	=	EXP(LUNRR)
IDEN43	LUNRR	=	LUNRND + LUNRN
IDEN44	BGFIR	=	BGFIRPxPOP
IDEN45	CD	=	CDPxPOP

...... Continued Table 4.3

IDEN46	CND	=	CNDPxPOP
IDEN47	CSD	=	CSDPxPOP
IDEN48	CS	=	CSPxPOP
IDEN49	HM	=	HMGPxNGDP

* Residual terms are added to these identities in order that they hold exactly in the data.

TABLE 4.4

Estimated Autoregressive (AR) Equations for Exogenous Variables

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EQ23. NINTUS

$$NINTUS = \underset{(2.04)}{0.004} + \underset{(12.86)}{1.22}(NINTUS)_{-1} - \underset{(-3.56)}{0.519}(NINTUS)_{-2} +$$

$$\underset{(3.59)}{0.525}(NINTUS)_{-3} - \underset{(-3.46)}{0.334}(NINTUS)_{-4} +$$

$$\underset{(1.56)}{0.00005}(T)$$

$\bar{R}^2 = 0.918$ S.E. = 0.008 $\hat{\rho} = 0.06$

EQ24. G

$$G = \underset{(1.61)}{1503} + \underset{(7.84)}{0.769}(G)_{-1} - \underset{(-0.09)}{0.012}(G)_{-2} + \underset{(0.61)}{0.076}(G)_{-3} +$$

$$\underset{(1.47)}{0.147}(G)_{-4} + \underset{(0.36)}{6.68}(T)$$

$\bar{R}^2 = 0.998$ S.E. = 760.1 $\hat{\rho} = -0.02$

......Continued Table 4.4

EQ25. X

$$X = \underset{(1.39)}{961.2} + \underset{(8.80)}{0.879}(X)_{-1} + \underset{(1.02)}{0.137}(X)_{-2} + \underset{(0.46)}{0.062}(X)_{-3} - \underset{(-1.22)}{0.130}(X)_{-4} + \underset{(1.58)}{69.05}(T)$$

$\bar{R}^2 = 0.994$ S.E. = 2599 $\hat{\rho} = 0.007$

EQ26. PIM

$$PIM = \underset{(2.29)}{0.009} + \underset{(12.9)}{1.28}(PIM)_{-1} - \underset{(-1.08)}{0.178}(PIM)_{-2} + \underset{(0.38)}{0.063}(PIM)_{-3} - \underset{(-1.94)}{0.197}(PIM)_{-4} + \underset{(2.03)}{0.0002}(T)$$

$\bar{R}^2 = 0.998$ S.E. = 0.009 $\hat{\rho} = 0.003$

EQ27. PINV

$$PINV = \underset{(1.57)}{43.9} - \underset{(-1.70)}{0.169}(PINV)_{-1} + \underset{(0.58)}{0.059}(PINV)_{-2} - \underset{(-0.11)}{0.011}(PINV)_{-3} - \underset{(-1.14)}{0.114}(PINV)_{-4} - \underset{(-1.18)}{0.489}(T)$$

$\bar{R}^2 = 0.008$ S.E. = 125.5 $\hat{\rho} = -0.01$

EQ28. PGFI

......Continued Table 4.4

$$PGFI = \underset{(2.48)}{653.9} + \underset{(11.5)}{1.15}(PGFI)_{-1} - \underset{(-0.61)}{0.092}(PGFI)_{-2} -$$

$$\underset{(-1.39)}{0.197}(PGFI)_{-3} + \underset{(0.47)}{0.045}(PGFI)_{-4} + \underset{(2.28)}{3.86}(T)$$

$\bar{R}^2 = 0.977$ S.E. = 202.6 $\hat{\rho} = 0.002$

EQ29. INVF

$$INVF = \underset{(2.49)}{351.7} + \underset{(9.58)}{0.975}(INVF)_{-1} - \underset{(-1.57)}{0.221}(INVF)_{-2} -$$

$$\underset{(-0.95)}{0.137}(INVF)_{-3} + \underset{(0.15)}{0.018}(INVF)_{-4} - \underset{(-2.09)}{4.03}(T)$$

$\bar{R}^2 = 0.663$ S.E. = 530.5 $\hat{\rho} = 0.01$

EQ30. PKAP

$$PKAP = \underset{(2.50)}{594.2} + \underset{(14.5)}{1.45}(PKAP)_{-1} - \underset{(-0.65)}{0.113}(PKAP)_{-2} -$$

$$\underset{(-1.61)}{0.277}(PKAP)_{-3} - \underset{(-0.69)}{0.069}(PKAP)_{-4} + \underset{(1.68)}{9.11}(T)$$

$\bar{R}^2 = 0.999$ S.E. = 100.2 $\hat{\rho} = -0.0002$

Note: All AR equations were estimated by OLS over the sample period 1962:4 to 1988:4.

Table 4.5

Results of Historical Simulation (Dynamic)

(1970:4 to 1988:4)

Variable	Mean	RMS	RMSP	Theil's U
CDP	1135.72	106.34	0.10	0.91
CNDP	2391.82	72.77	0.03	0.97
CSDP	844.48	38.74	0.05	0.86
CSP	3384.53	81.64	0.02	0.61
BGFIRP	847.31	80.59	0.10	1.47
BGFKNR	0.08	0.01	0.08	0.98
BGFKME	0.16	0.02	0.11	0.98
INVNFGP	0.01	0.02	11.16	3.19
IMGP	0.24	0.02	0.08	0.92
NTRGP	0.10	0.01	0.05	0.96

.... Continued Table 4.5

NTXPI	0.18	0.01	0.07	1.00
NCXPF	0.33	0.04	0.11	0.99
WDOT	0.08	0.02	0.61	0.86
NNLIGP	0.16	0.01	0.09	1.00
NCPFGP	0.11	0.01	0.14	0.98
ER	1.15	0.06	0.05	1.05
NINT	0.09	0.01	0.14	0.59
HMGP	0.05	0.00	0.05	1.12
PDOT	0.07	0.02	0.57	0.87
GDP	33592.60	10475.99	0.03	1.94
UNR	0.08	0.01	0.14	0.96
PGDP	339280.44	518.76	0.00	0.04

Fig 4.1
Gross Domestic Product
GDP

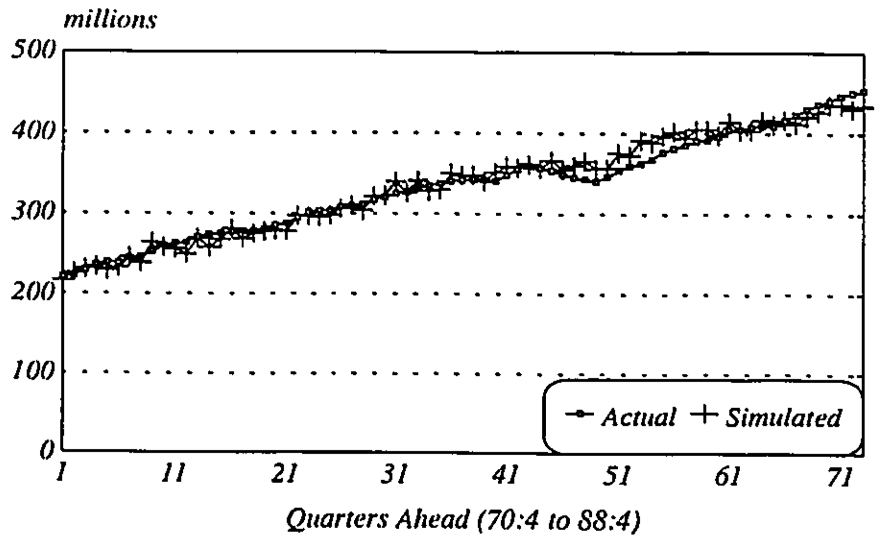


Fig 4.2
Rate of Unemployment
UNR

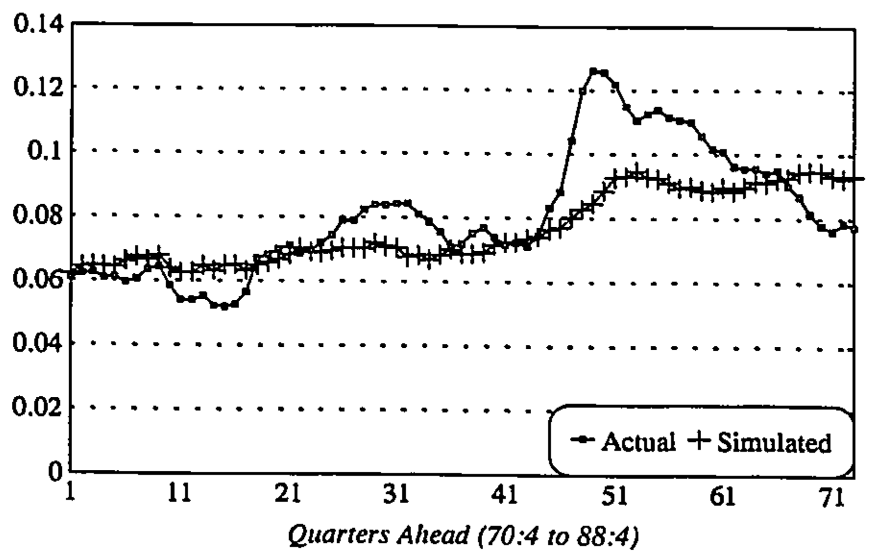
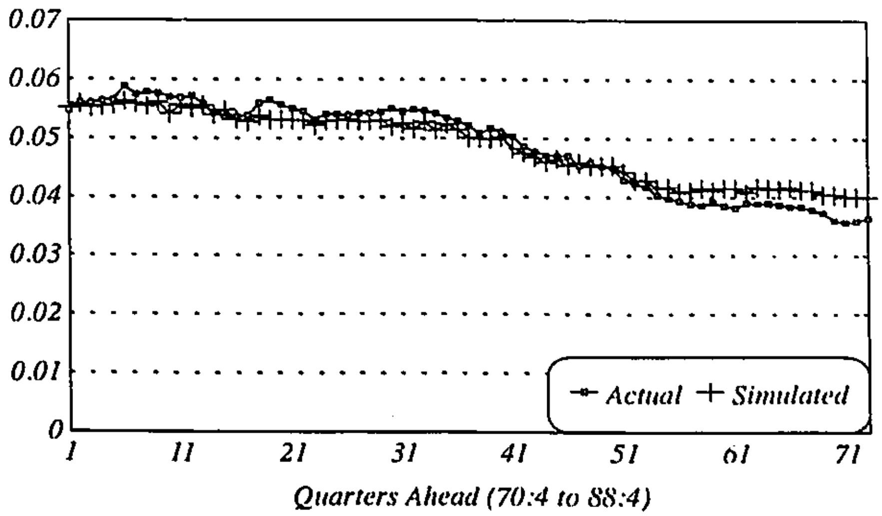


Fig 4.3
High Powered Money*
HMGP



*** Divided by Nominal GDP**

Fig 4.4
Rate of Change in GDP Deflator
PDOT

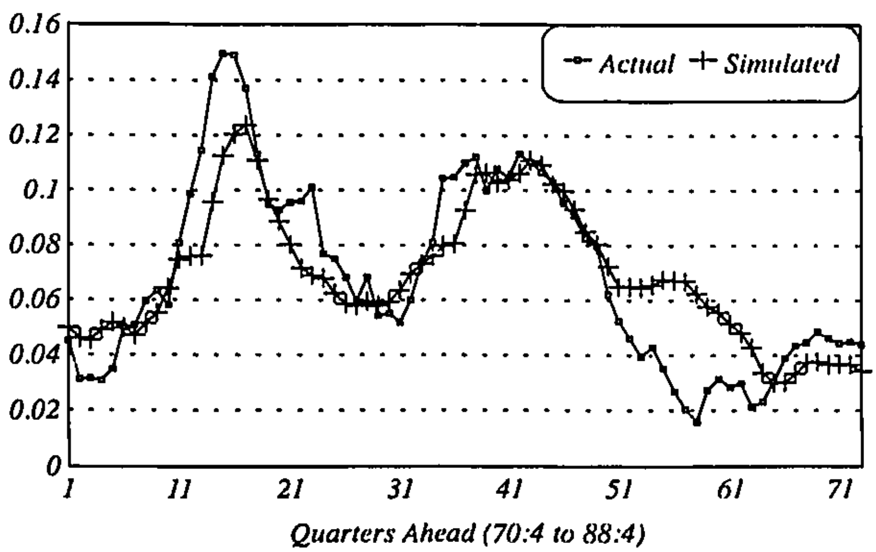
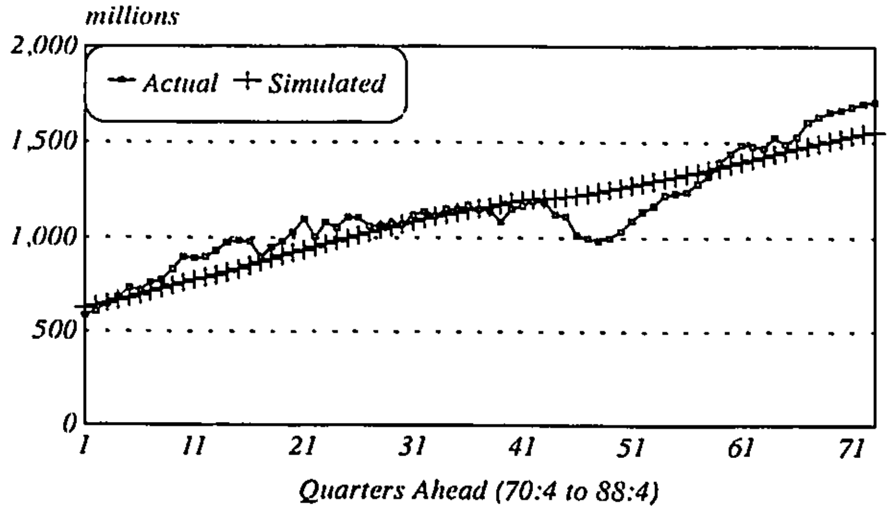
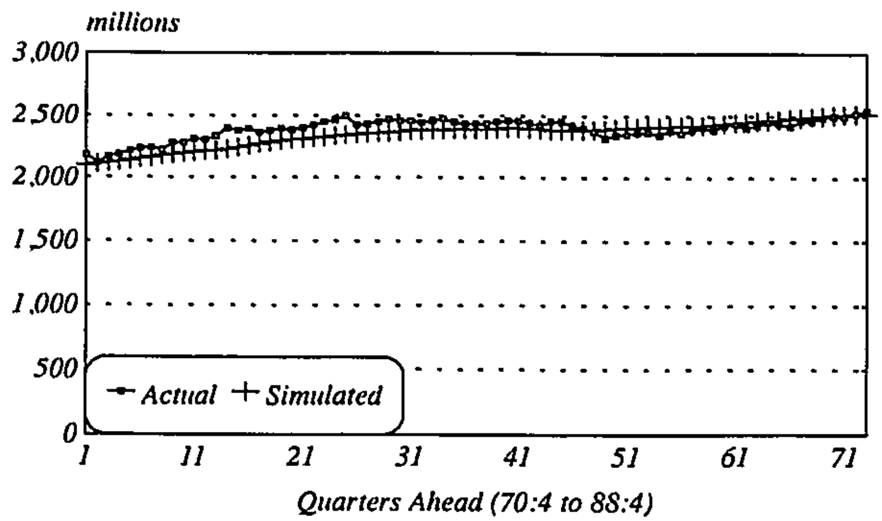


Fig 4.5
Consumer Expenditures on Durables*
CDP



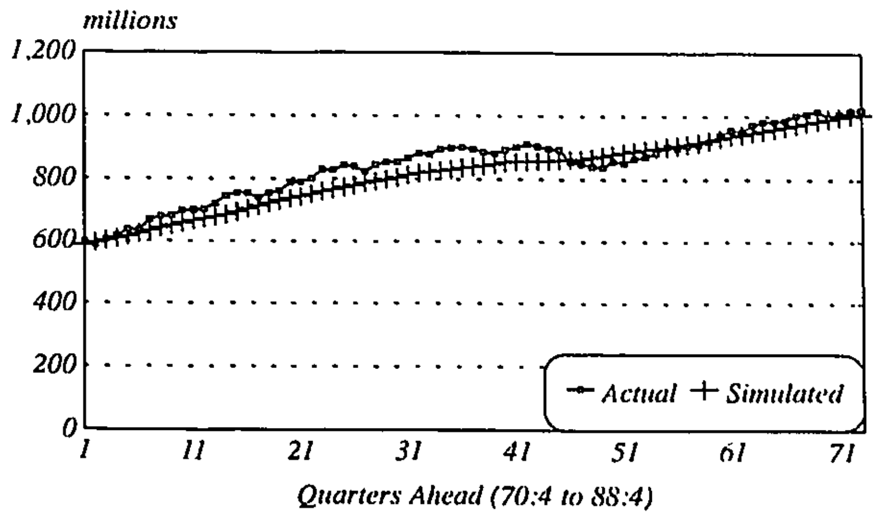
* *Per Capita*

Fig 4.6
Consumer Expenditures on Non-Durables*
CNDP



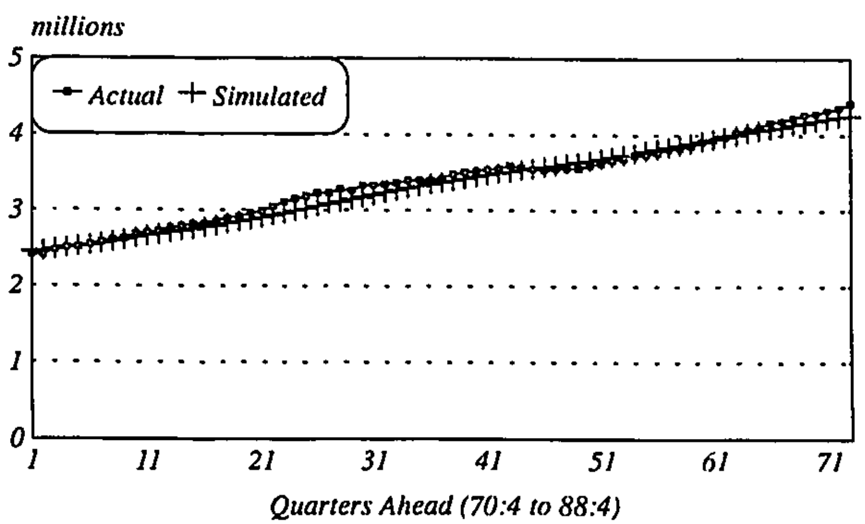
* *Per Capita*

Fig 4.7
Consumer Expenditures on Semi-Durables*
CSDP



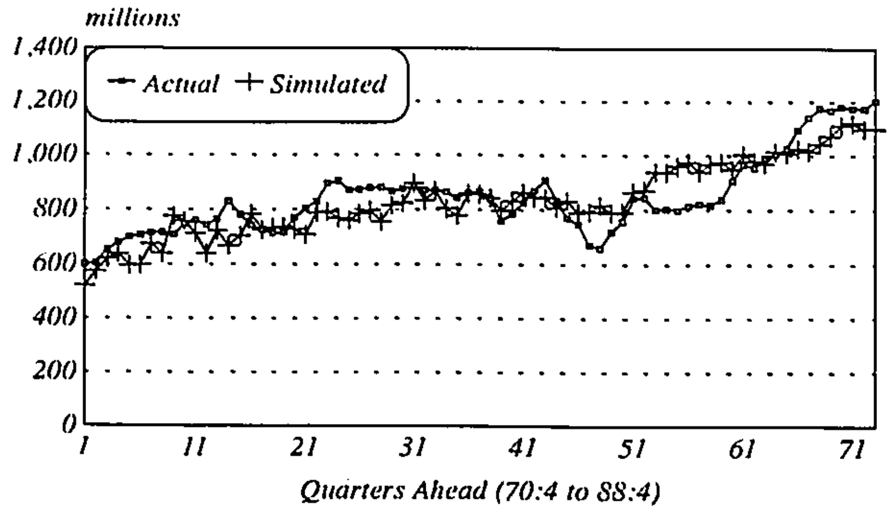
* Per Capita

Fig 4.8
Consumer Expenditures on Services*
CSP



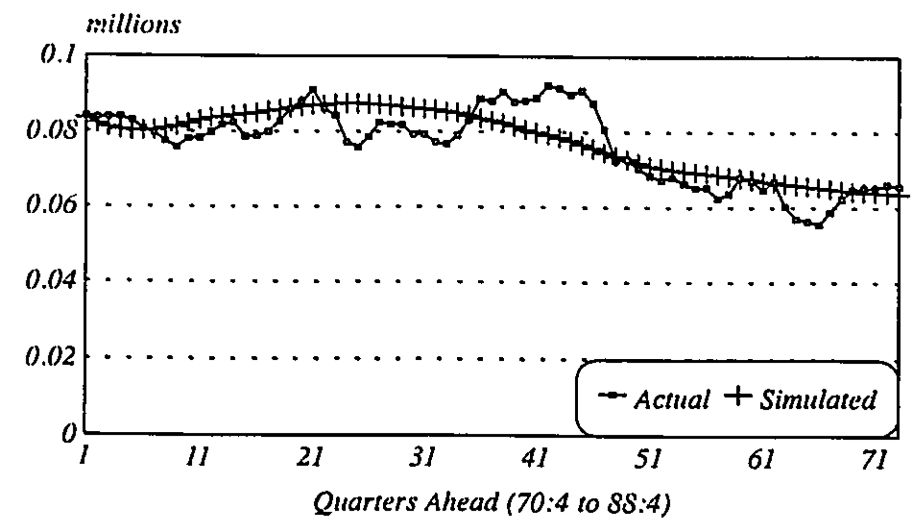
* Per Capita

Fig 4.9
*Business Gross Fixed Investment (Residential)**
BGFIRP



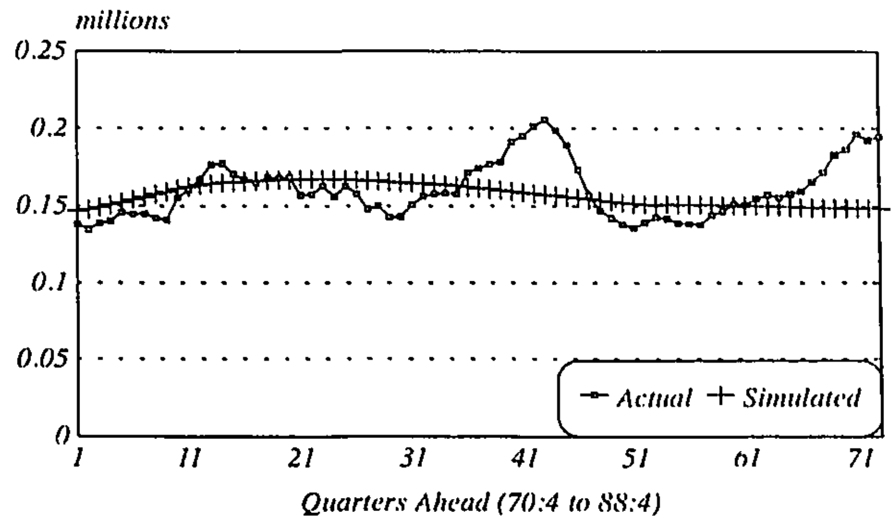
* Per Capita

Fig 4.10
*Business Gross Fixed Investment (Non-Residential)**
BGFKNR



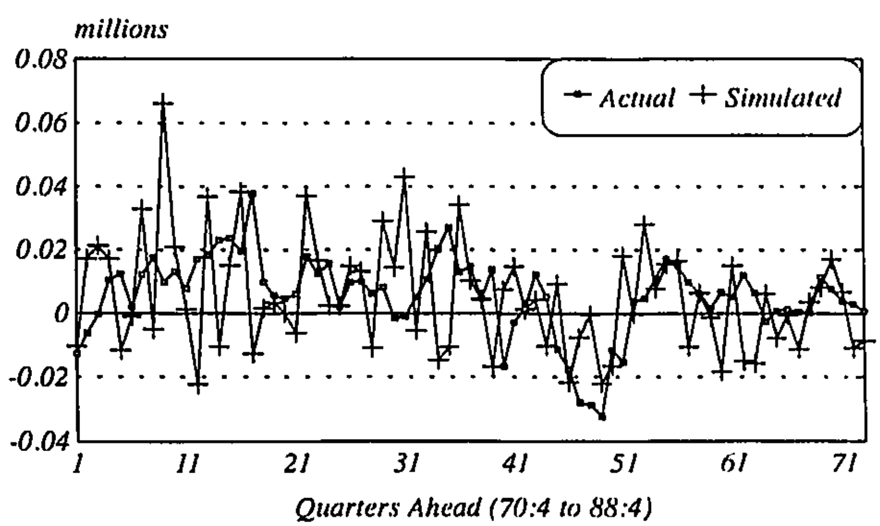
* Divided by Capital Stock

Fig 4.11
Business Gross Fixed Investment (Machinery & Equipment)*
BGFKME



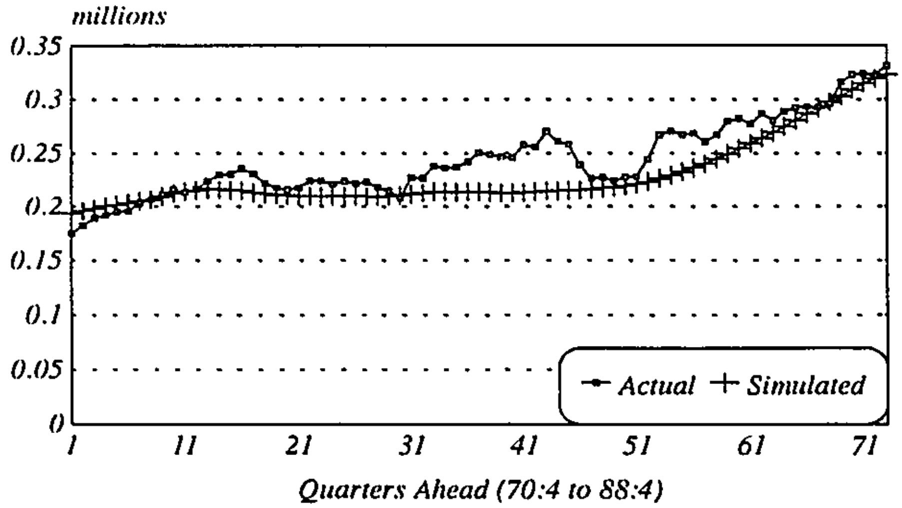
** Divided by Capital Stock*

Fig 4.12
Business Non-Farm Inventories*
INVNFGP



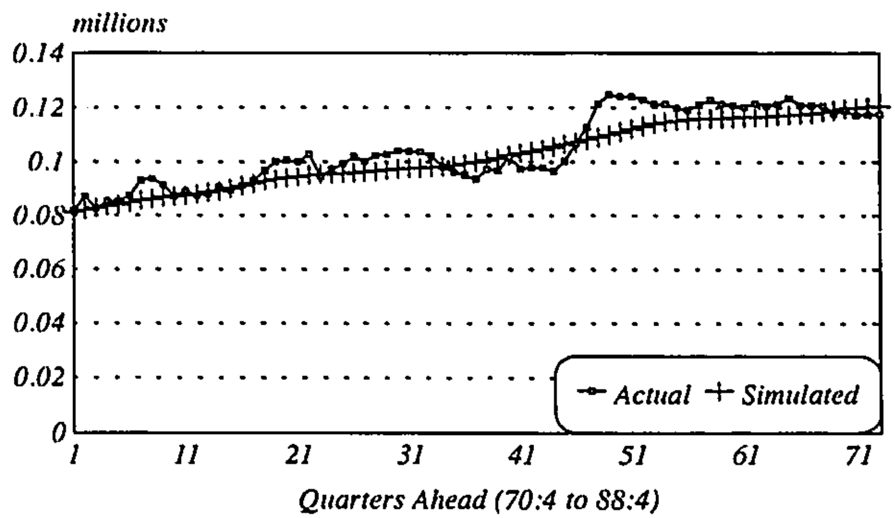
** Divided by GDP*

Fig 4.13
Total Imports*
IMGP



* *Divided by GDP*

Fig 4.14
Government Transfer Payments*
NTRGP



* *Divided by Nominal GDP*

Fig 4.15
Rate of Change in Nominal Wages
WDOT

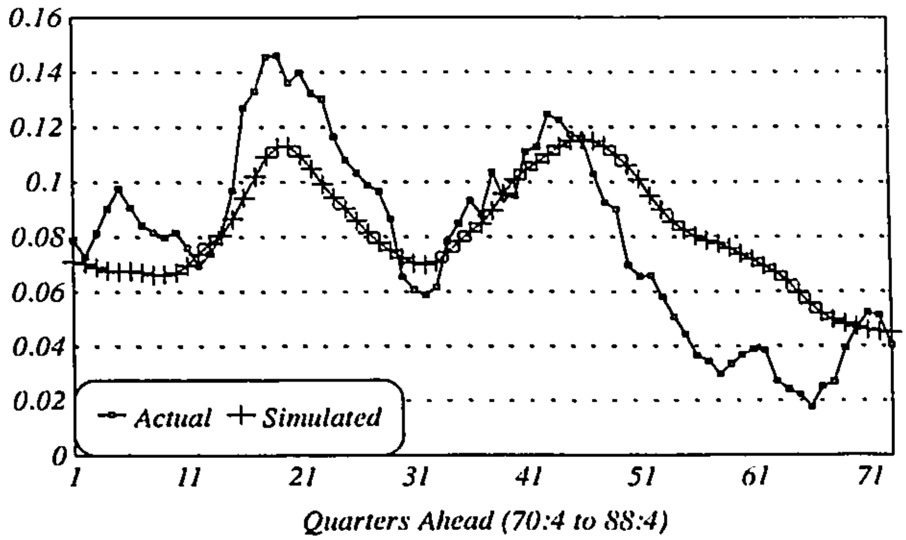


Fig 4.16
Potential GDP
PGDP

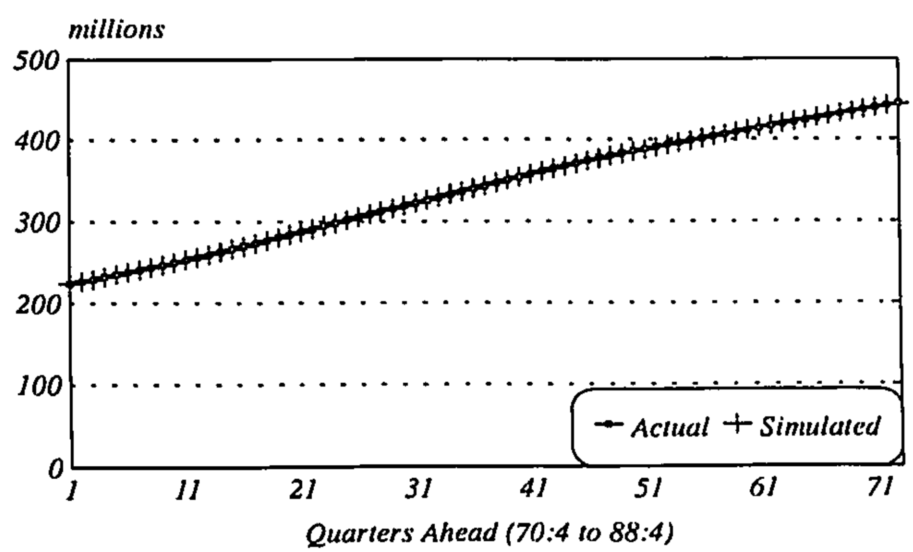


Fig 4.17
Exchange Rate
ER

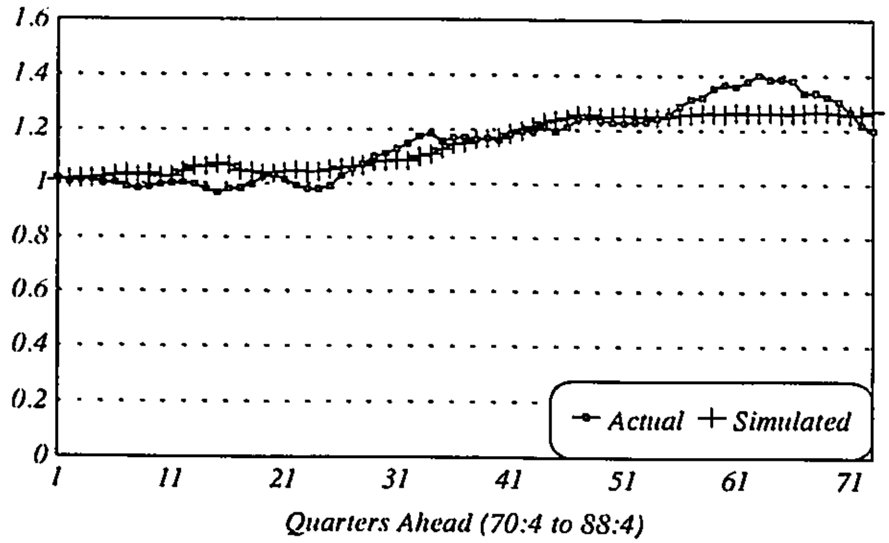


Fig 4.18
Rate of Interest
NINT

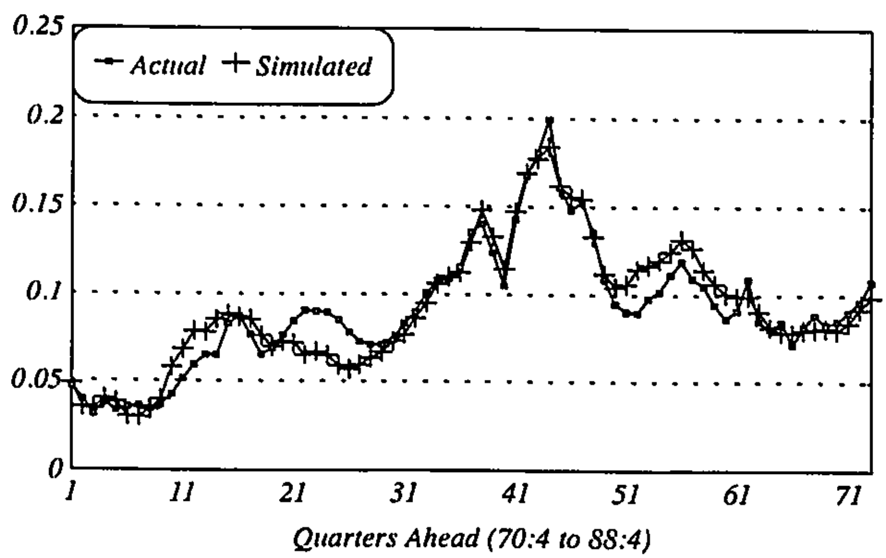
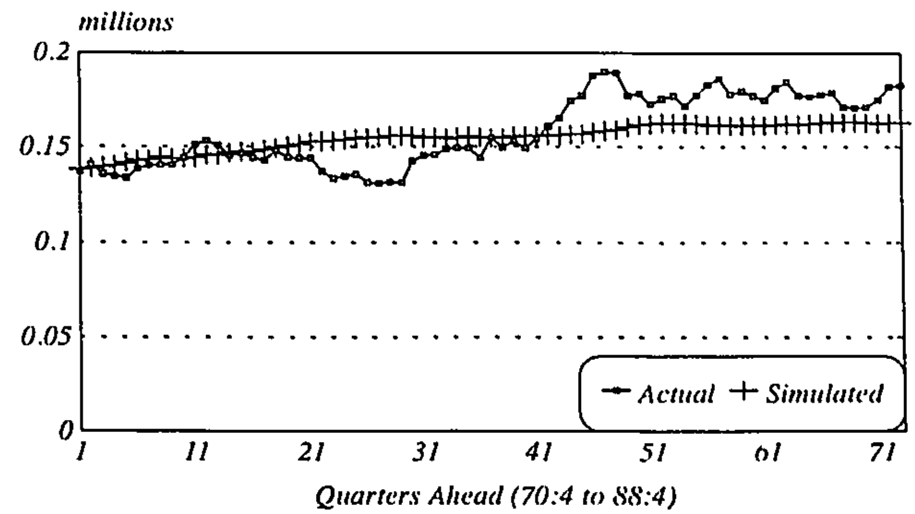
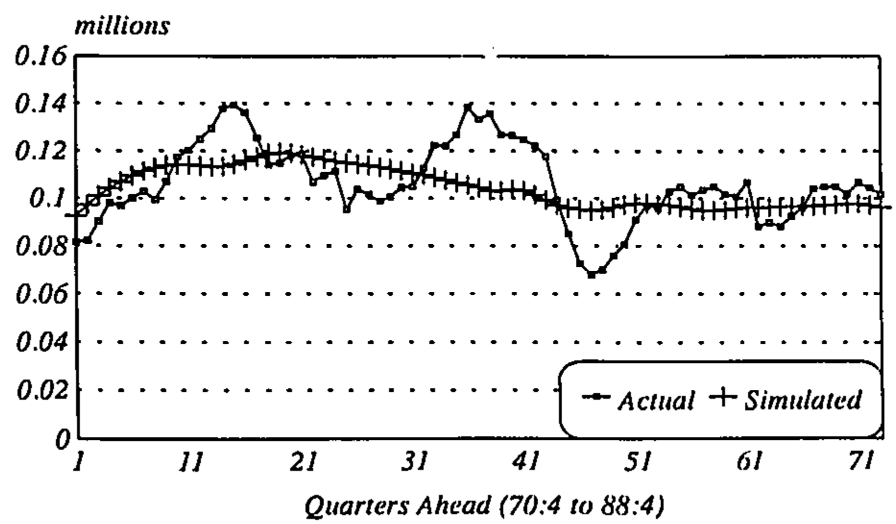


Fig 4.19
Non-Labour Income*
NNLIGP



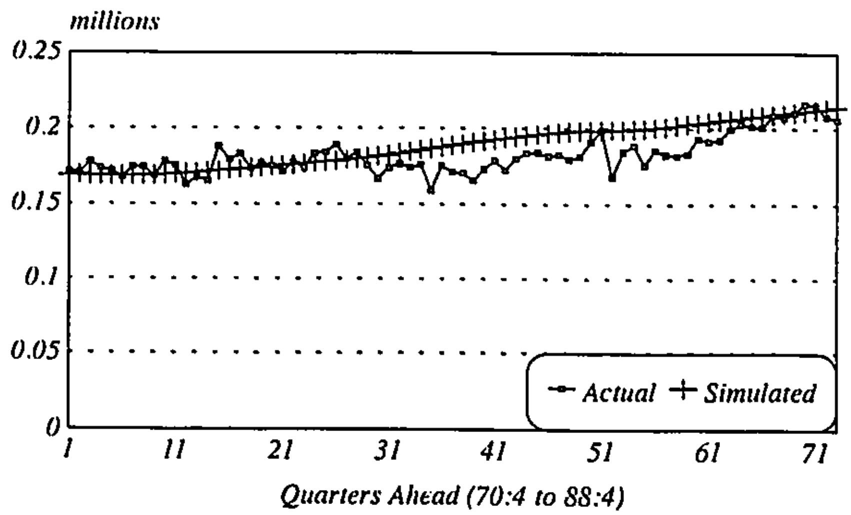
* Divided by Nominal GDP

Fig 4.20
Corporate Profits*
NCPFGP



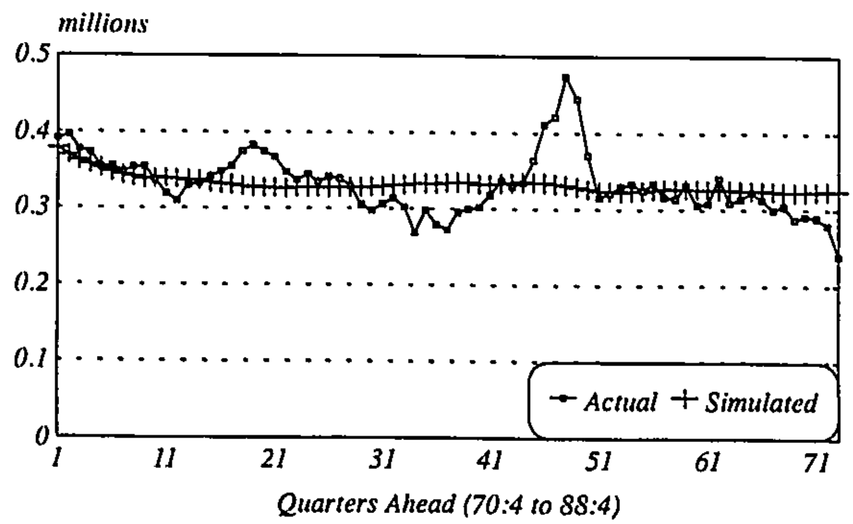
* Divided by Nominal GDP

Fig 4.21
Personal Taxes*
NTXPI



* Divided by Personal Income

Fig 4.22
Corporate Taxes*
NCXPF



* Divided by Corporate Profits

Appendix 4A

THE DATA

All series are quarterly, seasonally adjusted, and run from the second quarter of 1961 to the fourth quarter of 1988. All real variables are in 1981 prices.

Sources of Data

1) BCR: Bank of Canada Review.

2) BCT: Bank of Canada Technical Repoıts.

3) EEH: Employment, Earnings and Hours (Statistic Canada, cat.: 72-002).

4) HLF: Historical Labour Force Statistic (Statistic Canada, cat.: 71-201).

5) NIEA: National Income and Expenditure Accounts (Statistic Canada,

cat.: CA1 BS13 C533).

6) SCB: Survey of Current Business, U.S. Department of Commerce/Bureau of Economic Analysis (cat.: US1 DC 130 S71).

7) QEP: Quarterly Estimates of Population for Canada and provinces (Statistics Canada, cat.: 91-001).

8) CANSIM: Canadian Socio-Economic Information Management System

Definition of Data Series:

All variables are real unless otherwise specified.

BGFI Total business gross fixed investment.
Source: CANSIM D20289

BGFIME Business gross fixed investment, machine and equipment. Source: CANSIM D20302

BGFINR Business gross fixed investment, non-residential. Source: CANSIM D20301

BGFIR Business gross fixed investment, residential.
Source: CANSIM D20296

BKAP Total business capital stock at end of period, obtained by summing three components: BKAP = BKAPR + BKAPNR + BKAPME.

BKAPME Business capital stock at end of period, machine and equipment.
Source: see app. 4B

BKAPNR Business capital stock at end of period, non-residential.
Source: see app. 4B

BKAPR	Business capital stock at end of period, residential. Source: see app. 4B
CD	Consumer expenditure on durable goods. Source: CANSIM D20132
CND	Consumer expenditure on non-durable. Source: CANSIM D20141
CON	Total consumption expenditure. Source: CANSIM D20131
CS	Consumer expenditures on services. Source: CANSIM D20147
CSD	Consumer expenditure on semi-durable. Source: CANSIM D20137
ER	Exchange rate, nominal (price of U.S. dollar in terms of Canadian dollar). Source[3] : CANSIM B3400
G	Govt current expenditures on goods and services. Source: CANSIM D20033
GDP	Gross domestic product. Source: CANSIM D20031
GDPV	Total sales defined as GDP less business farm and public inventories.
HM	High powered money, nominal, obtained by adding currency outside chartered banks and Bank of Canada notes and deposits at chartered banks. Source[1] : CANSIM B1604, B603.
IM	Total imports. Source: CANSIM D20048
INV	Total value of physical change in business inventories. Source: CANSIM D20043, D20042.
INVF	Total value of physical change in business farm inventories. Source: CANSIM D20043
INVNF	Total value of physical change in business non-farm inventories.

Source: CANSIM D20042

N — Employment, 15 years and over, both sexes. Source[2] : CANSIM D767608, HLF.

NCPROF — Total corporate profits (before taxes), nominal. Source: CANSIM D20003

NCTX — Total corporate direct taxes, nominal. Source: NIEA

NGDP — Gross domestic product, nominal. Source: CANSIM D20011

NINT — Interest rate (three month treasury bill), nominal. Source[3] : CANSIM B14007

NINTUS — U.S. interest rate, (yield on three month U.S. govt. securities) nominal. Source[3] : SCB

NLI — Labour income, nominal. Source: NIEA

NNLI — Non labour income (excluding transfer payments), nominal. Source: NIEA

NPI — Personal income, nominal. Source: NIEA

NPTX — Total personal direct tax revenue, nominal. Source: NIEA

NPYD — Personal disposable income, nominal. Source: CANSIM D20111

NS — Labour force, 15 years and over, both sexes. Source[2] : CANSIM D767606, HLF

NSF — Full employment level of labour force. Source: see app. 4B

NTR — Total transfer payments, nominal. Source: NIEA

NUNR — Natural rate of unemployment. Source: see app. 4B

P GDP price deflator. Source: CANSIM D20337

PGDP Potential GDP. Source: see app. 4B

PGFI Total public gross fixed investment. Source: CANSIM D20290

PGFIME Public gross fixed investment, machinery and equipment. Source: CANSIM D20293

PGFINR Public gross fixed investment, non-residential. Source: CANSIM D20292

PGFIR Public gross fixed investment, residential. Source: CANSIM D20291

PIM Implicit import price deflator. Source: CANSIM D20354

PINV Public inventories. Source: CANSIM D20035

PKAP Total public capital stock at end of period, obtained by adding three components: PKAP = PKAPR + PKAPNR + PKAPME.

POP Total population. Source: CANSIM D1

POP1 Total population, both sexes, 15 years and over. Source[4] : CANSIM D767284, QEP.

PRN Labour force participation rate. Source[2] : CANSIM D767610, HLF.

TGFI Total gross fixed investment. Source: CANSIM D20289

TKAP Total capital stock at end of period, obtained by adding total business and total public capital stocks.

UNR Rate of unemployment, 15 years and over, both sexes. Source[2] : CANSIM D767611, HLF

W Average weekly wages (industrial composite), nominal. Source[5] : CANSIM L1241, EEH

WOP Real crude oil price index, as computed by bank of canada. Source: BCT, No. 56

X Total exports. Source: CANSIM D20044

NOTES:

1. One of the original series, CANSIM B603, was not seasonally adjusted. We adjusted it for seasonal variation before adding it to CANSIM B1604 to get the final series for HM.

2. Some adjustments were made to these series, since the data were obtained from two sources: i) CANSIM (1966:1 to 1988:4), ii) HLF (1961:1 to 1965:4).

3. These series were adjusted for seasonal variation.

4. An adjustment was made for this series, since the data were obtained from two sources: i) CANSIM (1966:1 to 1988:4), ii) QEP (1961:1 to 1965:4).

5. Some changes in the method of calculating the series were made in 1983 by Statistic Canada. The data according to the new method are available, on CANSIM L1241, from 1883:2 to 1988:4. The data according to the old method, from 1961:1 to 1983:1, were obtained from EEH. An adjustment was made to reconcile the new and old series based on the ratio of the two in the second quarter of 1983, for which both were available.

Appendix 4B

4B.1. Potential Output (PGDP)

A constant returns to scale Cobb-Douglas production function that captures both short and long-term fluctuations is specified. It has the following form:

$$Y = A\,(TKAP)^{d}\,N^{b}e^{v*TM}e^{w*TM^{2}} \quad \text{...} \quad (4B.1)$$

where Y is total output (GDP), TKAP is the capital stock, N is employment, and TM, TM^2 are linear and quadratic time trends[11] reflecting technological change.

The equation can be rewritten as

$$Y = A\,(TKAP)^{d}\,[(1 - UNR)\,NS]^{b}e^{v*TM}e^{w*TM^{2}}\ , \quad \text{......................} \quad (4B.2)$$

where UNR is the actual unemployment rate and NS is the total labour force.

[11] The sample mean of the original trend series was subtracted to get TM and TM^2 .

The equation can be rewritten as

$$Y = A(TKAP)^{d}\,[(1 - NUNR)NS]^{b}[(1 - UNR)/(1 - NUNR)]^{b}$$

$$e^{v \cdot TM}e^{w \cdot TM^{2}} \qquad \text{...(4B.3)}$$

where NUNR is the natural rate of unemployment.

It is important to explain how the NS and NUNR series were obtained. NS is the product of POP (population) and PRN (the overall labour force participation rate)[12]. PRN is calculated as the prediction from regressing the actual participation rate on the actual unemployment rate and linear, quadratic and cubic time trends[13].

The estimated regression equation was

$$PRN = 0.586 - 0.325(UNR) - 0.108(T) + 0.475(T^{2}) - 0.262(T^{3}) \qquad \text{.............................. (4B.4)}$$

$\bar{R}^2 = 0.994$ S.E. = 0.003 D.W. = 0.935

We obtained estimates of the NAIRU (the non-accelerating-inflation rate of unemployment) for the period 1961 to 1985 from Fortin (1986)[14] , extended the series

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[12] PRN, POP, and UNR relate to persons 15 years of age and over.

[13] Before choosing this regression we tried regressing PRN on UNR with only a linear trend and only linear and quadratic trends.

[14] Fortin (1986). Page 16, Table 3.

to 1988, and smoothed it series by regressing it on a linear time trend to get our NUNR series.

Eq.(4B.3) was estimated initially by OLS, using data from 1961:3 to 1988:4. Difficulties were encountered in obtaining reasonable parameter estimates, as often happens when production functions are fitted to time series data, because of multicollinearity. Restrictions were imposed on the shares of labour and capital: d was set equal to 0.30 and b to 0.70[15] . We also corrected the equation for first-order autocorrelation. The final estimated[16] equation (obtained by taking logarithms and applying OLS) was

$$Y = e^{6.97}(TKAP)^{.30}\,[(1 - NUNR)NS]^{.70}[(1 - UNR)/(1 - NUNR)]^{.94}$$
$$e^{0.0024 \cdot TM}e^{-0.000018 \cdot TM^2} \quad \ldots\ldots (4B.5)$$

We calculated the full-employment labour force series (NSF) as the product of POP and NPRN (natural labour force participation rate). NPRN is obtained simply by using the values of NUNR in place of UNR in equation (4B.4). A potential output series was then generated by setting actual unemployment to full employment, so that [1 - UNR/1 - NUNR] = 1, and setting NS = NSF. Thus

$$PGDP = e^{6.97}(TKAP)^{.30}\,[(1 - NUNR)NSF]^{.70}e^{0.0024 \cdot TM}e^{-0.000018 \cdot TM^2} \quad \ldots\ldots (4B.6)$$

---

15 Before choosing these values, we tried restricting d in the range 0.2 to 0.4 and b, correspondingly, in the range 0.8 to 0.6 .

16 All estimates are statistically significant at the 1% level or better.

where PGDP is the potential output.

4B.2. Capital Stock Series

Since no quarterly series of capital stocks were available for the economy as a whole, it was necessary to generate our own series. We required estimates of the following:

1) Business capital stock, machinery and equipment (BKAPME),

2) Business capital stock, non-residential construction (BKAPNR),

3) Business capital stock, residential construction (BKAPR),

4) Public capital stock, machine and equipment (PKAPME),

5) Public capital stock, non-residential construction (PKAPNR),

6) Public capital stock, residential construction (PKAPR),

The above six series were generated using TSP[17], which calculates a particular capital stock series from a gross investment series, using a perpetual inventory method with a constant rate of depreciation. Let I be gross investment, K the capital stock, and δ the rate of depreciation. The capital stock estimate (K_t) at the end of period t is then given by

$$K_t = (1-\delta)K_{t-1} + I_{t-1}$$

[17] We used TSP (Time Series Processor), version 4.0. The procedure CAPITAL was used to generate the capital stock series.

The procedure starts from a capital stock benchmark at a specified observation. If the benchmark is in the middle of the sample, it uses a backward version of the formula,

$$K_t = (K_{t+1} - I_t)/(1 - \delta)$$

to compute values of the capital stock in periods before the benchmark date. The sample period for all the investment series was 1947:1 to 1988:4. We provided the benchmark figures in the middle of the sample period 1960:4, and all capital stock series were generated over a sample of 1962:1 to 1988:4. The following values for annual depreciation rates were assumed, based on an examination of earlier work by others using canadian data:

Capital stock	Annual Depreciation rate
i) BKAPME	0.085
ii) BKAPNR	0.030
iii) BKAPR	0.025
iv) PKAPME	0.085
v) PKAPNR	0.030
vi) PKAPR	0.025

these values were converted to quarterly rates since quarterly stock estimates were required.

Chapter 5

STOCHASTIC SIMULATION AND VARIANCE DECOMPOSITION

In this chapter, we will present the results of the variance decomposition exercises, for three endogenous variables: (i) Real GDP, (ii) the Rate of Unemployment (UNR), and (iii) the Rate of change of in GDP Price deflator (PDOT). Whereas we have selected these three endogenous variables, a variance decomposition exercise could be done in similar fashion for any other endogenous variable in the model . Although all model equations are estimated through the 4th quarter of 1988, we chose the eight quarter period beginning in 1985 quarter one and ending in 1986 quarter four, for stochastic simulation and variance decomposition because this period does not correspond to either recession or boom.

As discussed in chapter 2, two different procedures were used for stochastic simulation: (i) the distribution-based Fair's technique, and (ii) the distribution-free bootstrapping. Each stochastic simulation procedure was carried out using the three methods described in chapter 2 and identified as METHOD 1, METHOD 2, and METHOD 3. Thus variance decomposition exercises were performed for each of three endogenous variables GDP, UNR, and PDOT. However, as discussed in chapter 2, only the results using METHOD 3 will be discussed. We have used RATS (Regression Analysis of Time Series) version 4.01 for all simulations.

The discussion is organized as follows: First, we will outline the steps that are common to each stochastic simulation (Fair's technique and bootstrapping) procedure. Second, the results of each procedure will be discussed for each of the three endogenous variables. Third, the precision of the variance decomposition from both procedures will be discussed. Fourth, the results for all three endogenous variables will be compared. Fifth, a comparison with the results of other studies will be presented. Finally, the last section provides a brief summary of the chapter.

5.1. Stochastic Simulation (Fair's Technique and Bootstrapping) Based on 100 Trials

The model consists of 22 behavioral equations which determine the 22 endogenous variables. Thus the variance-covariance (VCV) matrix associated with these equations is of order 22 X 22. In order to take into account shocks associated with the exogenous variables, we have followed Fair and added autoregressive (AR) equations to the model for eight exogenous variables.[1] All eight AR equations were estimated by ordinary least squares (OLS) and include four lags, a linear time trend, and a constant. With the addition of the eight AR equations, the complete model used for stochastic simulations consists of 30 stochastic equations. Thus the complete estimated VCV matrix was of order 30 X 30; and, in total, there are 30 shocks (22 behavioral equation shocks and eight AR equation shocks) to be analyzed.

As a first step, 31 stochastic simulations of 100 trials each were performed for both stochastic simulation procedures (Fair's technique and bootstrapping) using both METHOD 1 and METHOD 2. In the first simulation the error terms for all equations were drawn, while in each of the remaining 30 simulations: i) the error term for one equation per simulation was not drawn (set to zero) (METHOD 1), or ii) only the error

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[1] AR equations were not used for the following exogenous variables: i) trend variables (T, TM) ii) population (POP), iii) natural rate of unemployment (NUNR), iv) full-employment labour force (NSF), and v) the rate of change in world oil price index (WOPDOT).

term for one equation per simulation was drawn (METHOD 2). We found that the sums of individual contributions of all 30 error terms to the variances of GDP, UNR and PDOT, for all quarters, in each procedure and for both methods, differed substantially from the total variance in the first simulation. One would expect these sums to be close to the total variance if the sum of all the covariances of the error terms across equations was close to zero (see (2A.2), (2A.3) pages 35-36). However, in our model the sum of covariances of error terms is very different from zero, so that the sums of all contributions turn out to be very different from the total variance. To check whether this problem was due to the non-linearity of the model, we also performed the same experiment with a simple four equation linear model and obtained similar results. These experiments prompted us to use METHOD 3, which compensates for the effects of covariances across error terms, for the interpretation of our results[2].

The simulations based on 100 trials, can also allow one to determine those equations whose error terms contribute very little to the total variance. In table 5.1, we have indicated, on the basis of METHOD 3, equations which contribute less than one percent of the total variance in all quarters for all three endogenous variables of interest (GDP, UNR, and PDOT) and for both stochastic simulation procedures. The results on which table 5.1 is based are presented in appendix 5A. On the basis of table 5.1, we decided not

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[2] To give the reader an idea of how different results can be using METHOD 1 & METHOD 2, we have included these results in tables 5.12, 5.13, 5.14, and 5.15, for GDP, and in relevant tables in the appendix 5A for PDOT and UNR. All results reported are based on 1000 trials.

to consider the individual error terms of 12 equations[3], leaving the error terms of the remaining 18 equations to be analyzed individually. The error terms of these 12 equations were grouped together or with other shocks as described in table 5.2.

5.2. Stochastic Simulation (Fair's Technique and Bootstrapping) Based on 1000 Trials

There were 30 individual or grouped shocks used for the 1000 trial simulations. These included 18 individual shocks together with the 12 grouped shocks identified in table 5.2. The procedure for this set of simulations follows the same pattern as the 100 trial simulations. As before, 31 stochastic simulations of 1000 trials each were performed[4]. In the first simulation the error terms for all equations were drawn, while in each of the remaining 30 simulations: i) the error term for one equation (for the 18 individual shocks) or the error terms for a group of equations (for the 12 group shocks) were not drawn (were set to zero) (METHOD 1), or ii) only the error term for one equation (for the 18 individual shocks) or the error terms for a group of equations (for the 12 group shocks)

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[3] While the effects of the error terms of the two interest rates (NINT and NINTUS) are opposite in case of GDP, but their contribution to the total variances of GDP and UNR is very small. The contribution of these interest rates to the variance of PDOT is larger but not offsetting (see tables 5A.1 - 5A.6). Thus, no information is lost if these shocks are grouped together.

[4] 31 stochastic simulations with 1000 trials took about 28 hours of cpu time over a 486 machine.

were drawn (METHOD 2).

Following Fair, the initial 1000 trial simulations for the Fair procedure were based on the assumption that the VCV matrix was block diagonal (with one 22 X 22 block and one 8 X 8 block), implying no correlation between the errors of the equations for the 22 endogenous variables and the errors for the 8 equations in the AR block. These results (tables 5.3, 5.4, 5.5) were significantly different from those obtained from the 1000 trial stochastic simulations using bootstrapping (tables 5.6, 5.8, 5.10). Further investigation revealed that the assumption that the VCV matrix was block diagonal was the cause of these differences. In particular, the effects of the correlation between the error terms of the AR equations determining the exogenous variables and the error terms for the other equations was not negligible and, thus, the VCV matrix could not be assumed to be block diagonal. Thus, 1000 trial simulations using the Fair procedure were repeated with the VCV matrix not assumed to be block diagonal. These results (reported in tables 5.7, 5.9, 5.11) were comparable to those based on the bootstrapping procedure.

Similar steps were followed for the 1000 trial simulations based on the bootstrapping procedure. The bootstrapping procedure differs from the Fair procedure in that instead of drawing random numbers from a multivariate normal distribution based on the VCV matrix, a vector of shocks was drawn through resampling of the actual residual series which were generated when the model was estimated. These results are reported in tables 5.6, 5.8, 5.10.

Since some of the model equations were estimated over different sample periods, the entire vector[5] of residuals obtained from these estimates also covered different sample periods. The longest common sample period (1970:4 to 1988:4) was used for all series of residuals in the bootstrapping exercise. In addition to using the actual residuals for the bootstrapping simulations. We also carried out simulations using the deviations of the actual residuals from their sample means[6]. Since the results were similar to those obtained using the actual residuals (compare tables 5.6 and 5A.15), only the results based on the actual residuals are discussed in this chapter.

5.3. Precision of the Variance Decomposition Estimates

As Fair has mentioned, there are three reasons why variance estimates generated by stochastic simulation are not equal to the true variances: (i) they are based on the estimated coefficients rather than actual coefficient values; (ii) they are based on the estimated VCV matrix rather than the actual matrix, and (iii) they are based on a finite number of trials. While ignoring the first two reasons[7], one can estimate the precision of the stochastic simulation estimates of the variances for a given number of trials. In other words, it is possible to estimate the variances and, thus, the standard errors of

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[5] We chose entire vector of residuals in order to keep the correlation among them.

[6] For estimation methods other than OLS, the means of the residuals are not constraint to zero.

[7] Considering reasons i) and ii) would have required random draws of values for each coefficient and each element of the VCV matrix for every simulation. This would have greatly increased the complexity and time required for the simulations.

$\hat{\sigma}^2_{it}, \hat{\theta}^2_{it}(g), \hat{\delta}_{it}(g)$ *and* $\hat{\eta}_{it}(g)$. However, since the magnitude of the standard error depends on the units of measurement for the particular variable, we have also calculated the unit-free measure of precision. The procedure used to perform these calculations is explained in appendix 2A.2.

The choice of 1000 trial simulations was based on the tradeoff between resource cost and the precision of the stochastic simulation estimates. Some 5000 trial simulations were tried, but these only increase the estimated precision of the stochastic simulation estimates by a small amount and did not change the stochastic simulation estimates of the variances themselves. In addition, we utilize a procedure also employed by Fair, of drawing the same random numbers (R's)[8] in estimating $\hat{\sigma}^2_{it}$ *and* $\hat{\sigma}^2_{it}(g)$, which helps reduce the variance of $\hat{\delta}_{it}(g)$. The variance of $\hat{\delta}_{it}(g)$

$$var[\hat{\delta}_{it}(g)] = var[\hat{\sigma}^2_{it}] + var[\hat{\sigma}^2_{it}(g)] - 2cov[\hat{\sigma}^2_{it}, \hat{\sigma}^2_{it}(g)]$$

depends negatively on the covariance between $\hat{\sigma}^2_{it}$ *and* $\hat{\sigma}^2_{it}(g)$ so that the

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[8] In stochastic simulation language, the same <u>SEED</u> was used in all simulations.

procedure increases this covariance and, thus, reduces the variance of $\delta_{it}(g)$ [9].

Measures of the precision of the stochastic simulation estimates for METHOD 3 (for both Fair's technique and bootstrapping) are presented in appendix tables 5A.16 - 5A.21. Each table shows the mean variance difference, $\hat{\eta}(g)$, the estimated standard error of this difference, $[v\hat{a}r(\hat{\eta}(g))]^{1/2}$, and the ratio of the two, ζ_3, for each shock and each quarter. In addition, the mean total variance, $\hat{\sigma}^2$, its estimated standard error, $[v\hat{a}r(\hat{\sigma}^2)]^{1/2}$, and the ratio of the mean variance to its standard error, ζ_b, are presented at the end of each table. For GDP, while the ratios of the mean total variance of, $\hat{\sigma}^2_{it}$, to its standard error range from 20.8 to 23.8, the same ratios for the variance differences range from 0.04 to 24.2. The standard errors of the variance differences relative to the mean variance differences are especially large for the shocks to the inventory change variables. INVF and Total3; the financial variables, ER and PIM;

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[9] The same procedure was also used in estimating $\hat{\sigma}^2_{it}$ *and* $\hat{\theta}^2_{it}(g)$ (METHOD 2) and $\hat{\sigma}^2_{it}$ *and* $\hat{\Theta}^2_{it}(g)$ (METHOD 3).

and the personal income variable, PIN. For the UNR and PDOT variables ratios of the mean variance differences to their standard errors also range widely, from 0.001 to 24.7. For the UNR variable, the standard errors of the variance differences are relatively large for the shocks to the inventory change variables, INVNF and Total3; the imports and exports variables, Total4; the public sector variable, OG; the financial variables, ER and HM; and the price variables, PIM and P. For the rate of inflation variable PDOT, the shocks to all of the above variables except P, have variance differences with relatively large standard errors. In addition, shocks to a number of other variables also have variance differences for PDOT with relatively large standard errors. These include the private expenditure variables, CD, CND, BGFINR, and BGFIME; the imports and export variables, IM and X; the income variables, W, PI, and NCPROF. When shocks lead to variance differences with relatively large standard errors, caution must be exercised in interpreting the variance differences.

5.4. The Variance Decomposition Results

5.4.1. Organization of the Results

As previously discussed, only the results based on METHOD 3 will be discussed. These results, using both Fair's procedure and bootstrapping are presented in tables 5.6

and 5.7 for GDP, tables 5.8 and 5.9 for PDOT, and tables 5.10 and 5.11 for UNR. Before proceeding further, it is important to emphasize that what is being estimated is the contribution of the error term in the equation for each exogenous variable to the total variance of GDP, PDOT or UNR. It should be noted that this contribution is different from the multiplier effect of the exogenous variable on GDP, PDOT or UNR. Each number in the tables shows the contribution of the corresponding shock as a percentage of the total variance (see equation (2.4.13)).

The same classification of shocks has been used for GDP, PDOT and UNR. Although any classification is somewhat arbitrary, it is helpful in presenting the results. The classification used here is based on five major categories: (A) shocks to private expenditure components of real GDP, which can be viewed as demand shocks; (B) shocks to public sector variables, or equivalently, fiscal shocks; (C) shocks to financial sector variables; (D) shocks to prices and income variables; and (E) shocks to unemployment and labour force variables. Each of these major categories is made up of several components. The first major category, (A), contains four components: (A.1) total personal consumption expenditure, which is subdivided into expenditures on durables, non-durables, semi-durables and services; (A.2) total business investment expenditure, which is subdivided into expenditures on residential construction, non-residential construction and machinery and equipment; (A.3) total business inventory investment which is subdivided into non-farm and farm inventories[10]; and (A.4) exports and imports. The second major category, (B), is made up of two components: (B.1) government current expenditures on goods and services; and (B.2) other public variables, which include transfer payments, personal direct tax revenue, corporate direct tax revenue, government inventory investment, government investment expenditures, and government capital stock. The third major category, (C), consists of three components: (C.1) the Canadian-U.S. exchange rate; (C.2) domestic and U.S. rates of interest (combined); and (C.3) high powered money. The fourth major category, (D), comprises five components: (D.1) the GDP price deflator; (D.2) nominal wages; (D.3) the price index for imports; (D.4) labour and non-labour income; and (D.5) corporate profits. The fifth and the last major category, (E), contains only two components, the rate of unemployment and the labour force[11].

All the tables include row which give the total contribution of a group of components. Rows labelled Total-a give the contribution when all components of the group are drawn or not drawn simultaneously. Rows labelled Total-b are obtained through the sum of all individual contributions included in that particular group. The difference between Total-a and Total-b is an indication of how much the correlation of the shocks across equations within the group matters. Also note that if this correlation is negative the contribution of some individual shocks can be negative. Total-c represents the sum of the contributions

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[10] Although the contribution of farm inventories is not being examined individually, Total3 includes this contribution.

[11] While the contribution of labour force is not being estimated individually, Total9 includes its contribution.

of all components.[12]

5.4.2. Contributions to the Variance of Real GDP

According to both procedures, the total contribution of shocks to private expenditure components of real GDP (or total demand shocks) is the largest and, on average over the simulation period, accounts for 90.5 percent (bootstrap) and 88 percent (Fair's technique) of the variance of real GDP (based on Total5-b). The relative contribution of these shocks declines over the simulation period. Among its components, imports and exports turn out to matter the most, accounting for 54.0 percent of (bootstrap) and 56.8 percent (Fair's technique) of the group contribution. In addition, shocks to exports have a substantially larger contribution than shocks to imports. Among other components of this group, total consumption shocks accounts for 23.8 percent (bootstrap) and 23.6 percent (Fair's technique); total investment accounts 24.0 percent (bootstrap) and 25.6 percent (Fair's technique); and inventory investment accounts for only -1.4 percent (bootstrap) and -4.9 percent (Fair's technique) of the group contribution.[13]

Total price and income shocks are the second largest contributor, accounting for on average, 5.4 and 5.1 percent of the variance of GDP. Shocks to corporate profits dominate

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[12] Total-c = Total5-b + Total6-b + Total7-b + Total8-b + Total9-b

[13] Because of the correlation of the error terms across equations, the contributions can be negative and the sum of individual contributions do not add to exactly 100 percent.

this group, accounting for 80 percent (bootstrap) and 92 percent (Fair's technique) of the group contribution, while the combined contribution of the GDP price deflator, nominal wages and the price index for imports, which could be considered as supply shocks, accounts for only 26 percent (bootstrap) and 17 percent (Fair's technique) of the group contribution.

The contributions of total public sector (or fiscal), total financial sector, and total unemployment and labour force shocks to the variance of real GDP are fairly small. Total public sector shocks contribute, on average, only 1.5 percent (bootstrap) and 2.6 percent (Fair's technique); total financial sector shocks contribute, on average, only 1.9 and 1.3 percent; and total unemployment and labour force shocks contribute, on average, only 1.5 and 1.3 percent of the total variance of real GDP.

On average, the top group contributors to the variance of GDP are similar according to both bootstrapping and Fair's technique. However, with the exception of the shocks to the export equation which invariably is the largest contributor, the top individual contributors vary both across the simulation period and across the two simulation procedures (see table 5.16). For example, for the first quarter, using the bootstrapping procedure, the five top contributors are: i) consumer expenditures on services (9.6 percent), ii) business fixed investment in machinery and equipment (8.6 percent), iii) consumer expenditures on nondurables (8.3 percent), iv) total imports (6.1 percent), and v) consumer expenditures on semi-durables (5.3 percent). For the same quarter, these contributors according to Fair's technique are: i) total imports (16.8 percent), ii) consumer expenditures on services (7.4 percent), iii) non-residential business fixed investment (6.5 percent), iv) consumer expenditures on semi-durables (4.8 percent), and v) business fixed investment in machinery and equipment (4.3 percent). For last quarter, the other five top contributors according to bootstrapping are: i) business fixed investment in machinery and equipment (11.3 percent), ii) imports (10.3 percent), iii) consumer expenditures on durables (9.9 percent), iv) corporate profits (8.1 percent), and v) non-residential business fixed investment (5.6 percent). For the same quarter the other top five contributors according to Fair's technique are: i) business fixed investment in machinery and equipment (11.9 percent), ii) consumer expenditures on durables (10.2 percent), iii) corporate profits (8.0 percent), iv) non-residential business fixed investment (6.9 percent) and v) imports (5.8 percent).

As we have already noted, the contributions of all the top contributors vary across the simulation period. While the estimated contribution of consumer expenditures on durables, for example, increases from -1.9 percent (bootstrap) and -1.7 percent (Fair's technique) to 9.9 and 10.2 percent, respectively, the contribution of consumer expenditures on services decreases from 9.6 and 7.4 percent to 3.9 and 3.4 percent. Since our simulations are limited to only eight periods, it is impossible to determine whether or not the relative contributions would stabilize over a longer simulation period.

5.4.3. Contributions to the Variance of the Rate of Change in the GDP Price Deflator (PDOT)

Only a few shocks make substantial contributions to the variance of PDOT. Unlike real GDP, the list of major contributors to the variance of PDOT is the same across the simulation period and for both simulation methods. Their relative contributions, however, do vary across the simulation period (see table 5.17). Since all the explanatory variables in the PDOT equation are predetermined except the domestic rate of interest (NINT), in the first quarter, only shocks to the rate of interest and PDOT equations contribute to the variation of PDOT. Although the shock to the PDOT equation is the largest contributor in all eight quarters, the domestic and U.S. rate of interest shock (NT), the exchange rate shock, and the total private expenditure components of GDP (or total demand) shock are also important, especially over the last four quarters of the simulation period. The contribution of the domestic and U.S. rate of interest shock increases from 4.3 percent (bootstrap) and 4.2 percent (Fair's technique) in the second quarter to 27.5 and 29.2 percent in the eighth quarter. The exchange rate contribution rises from -0.4 and -0.3 percent in the first quarter to 16.8 and 14.4 percent in the eighth quarter. The contribution of the total private expenditure component of GDP shock increase from 0.4 and 0.5 percent in the first quarter to 15 and 12.3 percent in the eighth quarter. While shocks to all the components of private expenditure contribute, the shocks to imports and exports have the largest contribution. As we have noted above, the price equation shock has the largest contribution for all quarters. Its relative contribution, however, decreases significantly from 94.5 and 93.3 percent in the second quarter to 37.5 and 40.1 percent in the last quarter. As was the case with GDP, since our simulations are limited to only eight quarters it is impossible to determine whether their relative contributions stabilize over a longer period. The analysis does seems to suggest however, that the source which is dominant in the short run may be less important in the long run.

5.4.4. Contributions to the Variance of the Rate of Unemployment (UNR)

As in the case of PDOT, there are only a few shocks which contribute significantly to the variance of UNR. The three largest contributors to the variance of UNR are the same across the simulation period and for both simulation methods. Their relative contributions, however, do vary across the simulation period (see table 5.18). Since all the explanatory variables are predetermined in the UNR equation, the shock to the UNR equation itself account for 100 percent of the variance, in the first quarter. Although the shock to the UNR equation itself is the largest contributor in all eight quarters, the contribution of the total private expenditure components of GDP (or total demand) shocks is also important, especially in the last four quarters. This total contribution increases from 4.2 percent (Fair's technique) and 5.9 percent (bootstrapping) in the second quarter to 34 percent (Fair's technique) and 33 percent (bootstrapping) in the last quarter. The contribution of total consumption goes from 1.1 and 1.9 percent to 10.6 and 11.7 percent, of total investment from 3.8 and 3.9 percent to 12.6 and 14.2 percent, and of total imports and exports from 0.2 and 1.3 percent to 14.5 and 14.7 percent.

As in the case of PDOT, the relative contribution of the UNR equation shock, although the largest in all eight quarters, decreases from 96.9 (Fair's technique) and 95.3 percent (bootstrapping) to 65.0 and 65.6 percent. On the other hand, the relative contribution of final expenditure shocks, such as exports, business fixed investment in machinery and equipment, and imports increases significantly. These results also seem to suggest that sources which are not major contributors in the short run may account for more of the variation in UNR in the long run. Finally it should be noted that shocks to the labour supply equation (NS) contribute little to the variation of UNR. However, the reader should be reminded that this does not imply that deterministic movements in NS have no influence on UNR.

Viewed together, these results suggest that shocks to real expenditure components contribute substantially to the variances of both GDP and UNR, while shocks to financial variables contribute substantially to variation in PDOT.

5.5. Comparison With the Results of Other Studies

In comparing our results with those of other studies, we will consider both other

Canadian studies and Fair's U.S. study. We consider Fair's results because his analysis is based on what we have described as METHOD 1, so that differences may be attributed to differences in methodology.

5.5.1. Comparison With Other Canadian Studies

We will consider Canadian studies based on both i) the VAR methodology, standard and structural variants, and ii) the index model. All Canadian VAR studies focus on Canadian-U.S. macroeconomic interaction and consider only Canadian output and prices in their variance decomposition exercises. The single index model study, on the other hand, only examines fluctuations in Canadian employment growth.

All the Canadian VAR studies suggest strong relationships between Canadian and U.S. variables, especially monetary variables, and conclude that U.S. economic activity strongly influences the Canadian economy. In a nine variable model based on monthly data from 1971 to 1983, Burbidge and Harrison (1985), though not undertaking a variance decomposition exercise, suggest that Canadian variables are significantly influenced by most major U.S. variables. While the U.S. interest rate is the most important variable for the determination of Canadian economic activity, the Canadian price level, however, is the only variable in their analysis that seems to be uninfluenced by U.S. variables.

Kuszczak and Murray (1987) obtained similar results by comparing closed and open-economy models estimated as a VAR system. The results of their variance decomposition analysis suggested that more than 50 percent of the forecast variance of each Canadian variable was explained by U.S. variables.

While the VAR studies cited thus far are based on the standard VAR methodology, Johnson and Schembri (1989) based their analysis on both the standard and structural VAR methodology. Their variance decomposition analysis indicates that U.S. variables(output and prices) are the largest contributors to fluctuations in Canadian output but are less important for fluctuations in Canadian prices. Most of the variation in Canadian prices is accounted for by its own shock.

The results obtained by Racette and Raynauld (1992), using the structural VAR technique, differ from those of other VAR studies, as far as the variation in Canadian inflation is concerned. Their analysis suggests that the U.S. prices play a much stronger role than Canadian monetary aggregates in the determination of Canadian inflation. Although Nadeem (1992) has found that the results are sensitive to alternative specifications of the VAR models (standard and structural), the U.S. variables do seem to contribute significantly to the variation of Canadian output and prices.

The above cited VAR studies give conflicting results concerning the importance of U.S. variables in accounting for variation in Canadian prices. Burbidge and Harrison (1985) and Johnson and Schembri (1989) find that the dominant source of fluctuation in Canadian inflation is its own shock. On the other hand, Kuszczak and Murray (1987), Racette and Raynauld ((1992), and Nadeem (1992) find that U.S. variables contribute substantially to variation in Canadian Prices. Our results show that, in first four quarters, the dominant source of fluctuation in Canadian inflation is its own shock, but that other variables, including the U.S. rate of interest and the exchange rate, become important after four quarters.

In the case of Canadian output, the VAR studies generally indicate the importance of both Canadian and U.S. variables. Some studies suggest that the U.S. variables are dominant, explaining more than 50 percent of the variation in Canadian output. Our analysis of the variation of Canadian output indicates that the total contribution of shocks to the private expenditure components of real GDP is the largest with export and import shocks dominating. Although we have not modelled the impact of U.S. variables on exports and imports explicitly, the significance of export and import shocks does indicate the importance of U.S. variables in the variation of Canadian output.

Altonji and Ham (1990), using the index model, found U.S. shocks to be the dominant source of variation in Canadian unemployment growth, accounting for about seventy percent of the variation. Our results, however, do not show the same importance of U.S. shocks in the variation of the rate of unemployment. In particular the contribution of export and import shocks rises from about 7 percent in the second quarter to over 20 percent in the last quarter. This result does indicate some importance for U.S. variables, since we can think of Canadian exports and imports as being affected by U.S. variables.

5.5.2. Comparison With Fair's Results for the U.S.

Fair (1988) has undertaken a variance decomposition exercise for U.S. GNP and the U.S. GNP deflator over a period of eight quarters based on what we have described as METHOD 1. First Considering real GNP, he also found that there were many important sources of variation and that their contributions varied across forecast period. The contribution of total demand shocks was the largest accounting for more than 70 percent of total variation over the forecast period. Among the demand shocks, the export equation shock, though not the largest, contributed significantly, especially over the last four quarters. Shocks to inventory investment, imports, consumption of durables and consumption of services were among the other top contributors. These results are comparable to ours.

Fair's results differ from ours, however, when the variance of the GNP deflator is examined. In Fair's results the shock to the price equation itself is largest in the first four quarters, but the shock to the import price equation becomes more important in last four quarters. In our results, the shock to the price equation itself is the largest contributor over all eight quarters and the domestic and U.S. rate of interest equation shocks become more important over last four quarters. In our results, the shock to the import price equation is never a significant contributor to the variance of PDOT.

Viewed as a whole, there are major similarities between Fair's results and our own, but there are also significant differences, especially for the source of variation in the price variables.

5.6. Summary

The relative contributions of various sources of variability in Canadian GDP, the rate of change of the GDP price deflator (PDOT), and the rate of unemployment (UNR) have been estimated by means of stochastic simulation based on both i) Fair's technique (a distribution-based procedure) and ii) bootstrapping (a distribution-free procedure). Although three methods were used for each simulation procedure the final interpretation of results is based on METHOD 3, which corrects for the impact of covariances between the shocks to different equations.

For real GDP, we found that the export and import equation shocks make the largest contribution, accounting for more than 55 percent of the variance, averaged over all eight quarters. With the exception of the export equation shock the relative importance of the other major individual contributors varies both over the simulation period and across the two simulation procedures. Consumer expenditures on services, business fixed investment in machinery and equipment, consumer expenditures on nondurables, total imports, and consumer expenditures on semi-durables are among the other major contributors. Thus demand shocks are the major contributors to the variance of GDP. The relative contributions of all the major contributors vary over the simulation period. For example, while the contribution of consumer expenditures on durables increases from -1.9 (bootstrap) and -1.7 percent (Fair's technique) in the first quarter to 9.9 and 10.2 percent in the last quarter, the contribution of consumer expenditures on services, however, decreases from 9.6 and 7.4 percent in the first quarter to 3.9 and 3.4 percent in the last quarter. Since our simulations were limited to only eight period, it was not possible to determine whether these relative contributions stabilize over a longer period.

Results for the rate of change in the GDP deflator (PDOT) and the rate of unemployment (UNR) are similar in that only a few shocks have a larger contribution. Like the results for real GDP, the relative importance of the major contributors to their variances are the same for both simulation methods but vary across the simulation period. The own equation shocks account for 100 percent of the variance in the first quarter due to the lag specification, but these contributions decline to about 40 percent (PDOT) and 65 percent (UNR) in the eighth quarter. The other major contributors are the domestic and U.S. rates of interest, the exchange rate, and total private expenditure components of real GDP in the case of PDOT; and total consumption, total investment, and total exports and imports in the case of UNR. For both variables the relative contribution of these major contributors varies over the simulation period. While some contributions increase significantly, some others decrease, from the first quarter to the last quarter. This seems to suggest that the sources which are dominant in the short run may not be as important in the long run.

Finally, although the U.S. variables were not modelled explicitly in our analysis, the import and export equations shocks are major contributors to the variances of all three endogenous variables GDP, PDOT and UNR; and the combined rate of interest shock and the exchange rate shock also are major contributors to the variance of PDOT. These results indicate that shocks to U.S. variables are also important. This conclusion consistent with the results of other several Canadian studies, which suggest the importance of U.S. variables in the explanation of variation in Canadian variables.

TABLES

GENERAL NOTES

- *Table 5.1 is based on 100 trials while all others are based on 1000 trials.*

- *Each number in these tables shows the percentage contribution of the shock to the total variance of the corresponding variable (GDP, PDOT or UNR).*

TABLE 5.1

Variance Decomposition
METHOD 3 (Based on 100 Trials)

	GDP		UNR		PDOT	
	FAIR	**BOOT**	**FAIR**	**BOOT**	**FAIR**	**BOOT**
Shock						
CD						
CND						*
CSD						*
CS						
BGFIR						
BGFINR						
BGFIME						
INVNF						
IM						
NTR	*	*	*	*	*	*
NPTX		*	*	*	*	*
NCTX				*	*	*
NS	*	*	*	*	*	*
UNR					*	
W			*	*		
NLI			*	*	*	*
NNLI				*	*	*
NCPROF						
ER			*	*		
NINT						
HM	*	*	*	*		
P	*	*	*	*		
NINTUS			*			
G					*	
X						
PIM			*	*	*	*
PINV	*	*	*	*	*	*
PGFI	*		*		*	*
INVF		*	*	*	*	*
PKAP	*	*	*	*	*	*

* Considered to be unimportant shocks.

TABLE 5.2

Grouping of Shocks for 1000 trial Experiment

Shocks not considered individually:

NTR	NLI	PINV
NPTX	NNLI	PGFI
NCTX	NINT	INVF
NS	NINTUS	PKAP

Grouping of Shocks:

Total1	=	CD + CND + CSD + CS
Total2	=	BGFIR + BGFINR + BGFIME
Total3	=	INVNF + INVF
Total4	=	IM + X
Total5	=	Total1 + Total2 + Total3 + Total4
OG	=	NTR + NPTX + NCTX + PINV + PGFI + PKAP
Total6	=	G + OG
NT	=	NINT + NINTUS
Total7	=	ER + HM + NT
PIN	=	NLI + NNLI
Total8	=	W + PIN + NCPROF + P + PIM
Total9	=	NS + UNR

TABLE 5.3

Variance Decomposition For Real GDP

METHOD 3 (Fair's Technique)*

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.2	1.6	3.1	2.6	3.5	3.5	4.3	4.3
CND	0.5	1.1	1.4	1.1	2.0	2.1	2.2	1.4
CSD	0.7	1.1	1.0	1.3	1.3	1.2	1.2	1.4
CS	0.5	1.5	1.4	1.0	1.8	0.5	1.9	1.7
Total1-a	1.9	5.4	6.8	6.0	8.5	7.3	9.6	8.8
Total1-b	1.9	5.4	6.8	6.0	8.5	7.2	9.6	8.8
A.2. Investment								
BGFIR	1.0	2.3	2.9	2.5	2.7	2.3	2.2	1.3
BGFINR	0.5	2.3	2.1	3.6	3.1	3.7	2.1	2.7
BGFIME	-1.1	2.9	5.1	4.2	4.9	4.6	5.8	6.4
Total2-a	0.9	6.5	9.9	11.4	10.2	10.5	9.9	10.2
Total2-b	0.3	7.6	10.1	10.3	10.6	10.6	10.0	10.4
A.3. Inventories								
INVNF	16.1	14.4	9.6	8.4	8.0	8.8	5.5	10.3
Total3-a	15.5	14.1	9.5	8.0	7.6	8.3	5.2	10.0
A.4. Imports & Exports								
IM	25.5	27.0	25.1	26.3	25.0	23.4	23.5	20.0

......Continued Table 5.3

X	53.1	42.2	43.7	44.0	40.8	40.3	39.9	38.3
Total4-a	79.3	69.4	69.3	70.7	66.1	63.9	64.1	58.2
Total4-b	78.5	69.2	68.8	70.3	65.8	63.7	63.4	58.3
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	97.9	96.2	95.6	95.5	92.5	90.4	89.6	87.5
Total5-b	96.3	96.2	95.2	94.5	92.5	89.8	88.2	87.4
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	1.2	1.4	1.2	0.5	1.7	0.5	0.9	0.8
B.2. Other components of Public Sector								
OG	0.7	1.3	1.1	1.2	1.2	1.7	1.6	1.2
Total Contribution of Public Sector								
Total6-a	1.9	2.7	2.3	1.7	2.9	2.2	2.5	2.0
Total6-b	2.7	4.1	3.4	2.9	4.2	3.9	4.1	3.2
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	0.1	0.1	0.1	0.2	0.4	0.2	1.0
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.2	0.5	1.3	1.0	1.2	2.2	2.0	2.2
C.3. High Powered Money								
HM	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
Total Contribution of Financial Sector								
Total7-a	0.2	0.6	1.3	1.1	1.4	2.6	2.2	3.2

......Continued Table 5.3

Total7-b	0.2	0.6	1.3	1.1	1.4	2.6	2.2	3.2
D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.7
D.2. Nominal Wages								
W	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.7
D.3. Price of Imports								
PIM	-0.0	-0.0	-0.2	0.2	0.8	1.7	2.0	2.6
D.4. Labour & Non-Labour Income								
PI	0.1	0.1	0.2	0.2	0.3	0.2	0.3	0.3
D.5. Corporate profits								
NCPROF	-0.0	0.4	0.8	1.1	1.6	2.3	2.6	2.7
Total Contribution of Prices & Income								
Total8-a	0.2	0.7	0.9	1.8	3.1	4.7	5.5	7.0
Total8-b	0.2	0.7	0.9	1.7	3.0	4.7	5.5	7.0
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	-0.2	-0.1	-0.1	-0.0	0.1	0.0	0.2	0.2
Total Contribution of Unemployment & Labour Force								
Total9-a	-0.2	-0.1	-0.1	-0.1	0.1	0.1	0.2	0.2
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* VCV matrix is assumed to be Block Diagonal.

TABLE 5.4

Variance Decomposition For Rate of Unemployment

METHOD 3 (Fair's Technique)*

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.2	0.4	0.9	1.3	1.9	2.6	3.2
CND	0.0	0.6	1.0	1.2	1.5	1.9	2.2	2.3
CSD	0.0	0.3	0.5	0.7	1.0	1.2	1.3	1.4
CS	0.0	0.4	0.9	1.5	1.6	1.9	1.7	1.9
Total1-a	0.0	1.1	2.7	4.2	5.3	6.7	7.7	8.7
Total1-b	0.0	1.0	2.7	4.2	5.3	6.8	7.7	8.7
A.2. Investment								
BGFIR	0.0	0.6	1.3	2.1	2.4	2.6	2.5	2.5
BGFINR	0.0	0.7	1.4	1.7	2.3	2.7	3.1	3.2
BGFIME	0.0	1.7	3.1	4.8	5.6	6.8	7.1	7.2
Total2-a	0.0	2.9	5.6	8.6	10.1	12.1	12.6	12.5
Total2-b	0.0	3.0	5.8	8.5	10.2	12.0	12.7	12.9
A.3. Inventories								
INVNF	0.0	1.7	1.4	1.1	-0.3	-1.3	-2.1	-2.7
Total3-a	0.0	1.6	1.3	1.0	-0.3	-1.5	-2.3	-3.0
A.4. Imports & Exports								
IM	0.0	-5.1	-5.5	-4.7	-3.8	-1.9	0.9	2.2

.... Continued Table 5.4

X	0.0	4.2	6.0	9.6	12.9	16.3	17.6	19.2
Total4-a	0.0	-0.9	0.6	4.9	9.0	14.4	18.5	21.5
Total4-b	0.0	-0.9	0.5	4.9	9.1	14.5	18.6	21.3
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	4.9	10.2	18.4	24.1	31.4	36.3	39.6
Total5-b	0.0	4.7	10.2	18.5	24.3	31.8	36.7	39.9
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	0.3	0.1	0.2	0.3	0.3	0.3	0.2
B.2. Other components of Public Sector								
OG	0.0	-0.2	-0.1	0.1	0.3	0.4	0.6	0.7
Total Contribution of Public Sector								
Total6-a	0.0	0.2	0.1	0.2	0.6	0.6	0.9	1.0
Total6-b	0.0	0.1	0.1	0.2	0.6	0.6	0.9	0.9
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.1
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.0	0.0	0.1	0.4	0.4	0.5	0.9	1.0
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Total Contribution of Financial Sector								
Total7-a	0.0	-0.1	-0.1	0.3	0.4	0.5	1.0	1.1
Total7-b	0.0	-0.1	-0.1	0.3	0.4	0.5	1.0	1.1

.... Continued Table 5.4

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0
D.2. Nominal Wages								
W	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.6
D.3. Price of Imports								
PIM	0.0	0.0	-0.1	-0.2	-0.1	-0.1	0.3	0.7
D.4. Labour & Non-Labour Income								
PI	0.0	-0.1	-0.2	-0.4	-0.5	-0.5	-0.5	-0.6
D.5. Corporate profits								
NCPROF	0.0	0.0	0.2	0.4	0.7	1.1	1.7	2.2
Total Contribution of Prices & Income								
Total8-a	0.0	-0.1	0.0	0.2	0.6	1.0	1.9	2.9
Total8-b	0.0	-0.1	0.0	0.1	0.5	0.9	1.9	2.9
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	95.1	89.9	81.0	74.5	66.6	60.0	55.5
Total Contribution of Unemployment & Labour Force								
Total9-a	100.0	95.1	89.8	81.0	74.6	66.6	60.1	55.5
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.1	100.1	100.1	100.0

* VCV matrix is assumed to be Block Diagonal.

TABLE 5.5

Variance Decomposition For Rate of Inflation

METHOD 3 (Fair's Technique)*

	Quarters Ahead							
	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	0.1	-0.1	-0.3	-0.5	-0.6	-0.7	-0.7
CND	0.0	-0.2	-0.1	0.0	-0.1	0.1	0.1	0.2
CSD	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0
CS	0.0	0.1	0.2	0.1	0.2	0.1	0.2	0.1
Total1-a	0.0	0.0	0.1	-0.1	-0.2	-0.4	-0.4	-0.4
Total1-b	0.0	-0.0	0.1	-0.1	-0.2	-0.3	-0.4	-0.4
A.2. Investment								
BGFIR	0.0	0.4	0.8	0.7	0.7	0.9	0.9	0.9
BGFINR	0.0	-0.2	-0.1	0.0	0.6	0.7	0.6	0.1
BGFIME	0.0	-0.2	-0.3	-0.1	0.2	0.1	0.1	0.0
Total2-a	0.0	-0.0	0.2	0.5	1.3	1.9	1.9	0.6
Total2-b	0.0	-0.1	0.4	0.6	1.4	1.7	1.6	0.9
A.3. Inventories								
INVNF	0.0	2.2	3.0	2.5	1.3	0.9	1.2	0.2
Total3-a	0.0	2.2	2.8	2.4	1.3	0.8	1.1	-0.1
A.4. Imports & Exports								
IM	0.0	1.2	3.8	6.2	8.0	9.3	9.8	10.8

.... Continued Table 5.5

X	0.0	4.8	9.5	10.6	12.2	13.4	12.9	13.5
Total4-a	0.0	6.0	13.4	16.7	20.2	22.7	22.7	24.3
Total4-b	0.0	5.9	13.3	16.7	20.2	22.7	22.7	24.3
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	8.1	16.8	19.6	22.7	24.7	24.9	24.9
Total5-b	0.0	8.0	16.5	19.6	22.6	24.7	24.9	24.8
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	0.2	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4
B.2. Other components of Public Sector								
OG	0.0	0.1	0.3	0.4	0.4	0.4	0.5	0.6
Total Contribution of Public Sector								
Total6-a	0.0	0.2	0.1	0.1	0.0	0.0	0.1	0.2
Total6-b	0.0	0.2	0.1	0.1	0.0	0.0	0.1	0.2
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.3	-0.2	1.3	3.7	6.5	9.7	11.9
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	3.7	4.9	7.7	11.1	15.6	18.5	21.9	23.8
C.3. High Powered Money								
HM	0.0	0.4	0.2	0.1	0.3	1.1	2.3	3.8
Total Contribution of Financial Sector								
Total7-a	3.7	5.0	7.8	12.4	19.5	26.0	33.7	39.4
Total7-b	3.7	5.0	7.8	12.4	19.6	26.0	33.8	39.4

.... Continued Table 5.5

D. <u>Prices & Income</u>								
D.1. GDP Deflator								
P	96.3	84.4	73.1	65.0	54.6	45.7	37.4	31.3
D.2. Nominal Wages								
W	0.0	2.4	2.2	2.6	2.7	2.8	2.5	2.5
D.3. Price of Imports								
PIM	0.0	0.0	0.2	0.3	0.5	0.7	1.1	1.2
D.4. Labour & Non-Labour Income								
PI	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5
D.5. Corporate profits								
NCPROF	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.1	-0.1
Total Contribution of Prices & Income								
Total8-a	96.3	86.9	75.5	67.9	57.7	49.2	41.1	35.4
Total8-b	96.3	86.8	75.5	67.9	57.7	49.2	41.2	35.4
E. <u>Unemplotment & Labour Force</u>								
E.1. Unemployment Rate								
UNR	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.3
Total Contribution of Unemployment & Labour Force								
Total9-a	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.1	100.0	100.1	100.0	100.0

* VCV matrix is assumed to be Block Diagonal.

TABLE 5.6

Variance Decomposition For Real GDP

METHOD 3 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	-1.9	6.2	8.4	9.2	9.6	9.0	9.6	9.9
CND	8.3	5.8	6.6	4.8	4.6	4.3	2.6	3.5
CSD	5.3	3.6	3.7	3.2	2.9	2.9	2.0	2.4
CS	9.6	7.6	6.1	5.1	4.1	4.7	4.2	3.9
Total1-a	21.6	23.3	24.9	22.4	21.4	20.9	18.4	19.8
Total1-b	21.3	23.2	24.9	22.3	21.3	20.9	18.4	19.8
A.2. Investment								
BGFIR	4.0	6.7	6.2	4.8	3.2	3.2	2.1	2.9
BGFINR	3.9	7.1	6.7	6.4	6.3	6.4	5.7	5.6
BGFIME	8.6	10.3	11.7	12.7	12.3	14.2	11.2	11.3
Total2-a	17.1	24.3	24.6	24.1	21.8	24.0	19.0	19.8
Total2-b	16.6	24.1	24.5	23.9	21.8	23.9	19.0	19.7
A.3. Inventories								
INVNF	-4.5	-4.7	-2.4	-1.8	-3.2	1.3	5.0	0.2
Total3-a	-5.3	-4.7	-2.5	-2.4	-3.3	1.4	4.8	-0.0
A.4. Imports & Exports								
IM	6.1	13.3	12.2	10.4	14.7	7.5	10.3	10.3

.... Continued Table 5.6

X	62.1	37.8	35.7	37.9	33.9	33.1	32.6	33.0
Total4-a	65.6	50.7	47.1	48.0	48.2	40.3	42.5	43.5
Total4-b	68.2	51.1	47.9	48.3	48.6	40.6	42.9	43.3
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	97.2	93.6	93.5	91.7	88.1	86.4	84.9	83.0
Total5-b	100.8	93.7	94.8	92.1	88.3	86.7	85.1	82.8
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	1.0	2.3	0.8	0.6	1.9	1.1	1.0	0.9
B.2. Other components of Public Sector								
OG	-0.7	-0.2	0.2	0.5	0.9	0.8	0.5	0.1
Total Contribution of Public Sector								
Total6-a	0.3	2.1	1.0	1.1	2.8	1.9	1.6	1.0
Total6-b	0.3	2.1	1.0	1.1	2.8	1.9	1.6	1.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.2	0.0	0.1	0.6	-0.1	0.2	0.8	0.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.6	1.5	1.4	1.7	2.2	2.0	2.7	2.2
C.3. High Powered Money								
HM	0.0	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
Total Contribution of Financial Sector								
Total7-a	0.8	1.4	1.4	2.1	1.9	2.0	3.3	2.3
Total7-b	0.8	1.4	1.4	2.1	1.9	2.0	3.3	2.3

.... Continued Table 5.6

D. Prices & Income								
D.1. GDP Deflator								
P	-0.1	-0.1	-0.1	-0.1	0.0	0.4	0.6	0.8
D.2. Nominal Wages								
W	0.5	0.7	0.7	0.6	0.8	0.8	1.1	1.4
D.3. Price of Imports								
PIM	0.2	-0.1	-0.1	-0.5	0.1	1.0	0.4	1.8
D.4. Labour & Non-Labour Income								
PI	0.2	-0.1	-0.3	-0.3	-0.2	-0.3	-0.2	-0.5
D.5. Corporate profits								
NCPROF	0.0	1.4	2.7	4.0	5.0	6.3	6.6	8.1
Total Contribution of Prices & Income								
Total8-a	0.9	1.8	2.8	3.6	5.6	8.1	8.5	11.6
Total8-b	0.9	1.8	2.9	3.6	5.6	8.1	8.4	11.5
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.4	0.8	0.9	1.1	1.1	1.3	1.4	1.7
Total Contribution of Unemployment & Labour Force								
Total9-a	0.7	1.1	1.2	1.5	1.5	1.7	1.8	2.1
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.0	100.0	100.1	100.0

TABLE 5.7

Variance Decomposition For Real GDP

METHOD 3 (Fair's Technique)*

Quarters Ahead	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	-1.7	5.5	8.9	8.5	9.9	10.3	10.3	10.2
CND	2.4	3.9	4.9	4.9	5.2	5.3	5.7	4.6
CSD	4.8	4.0	3.6	3.6	3.0	3.1	2.9	2.9
CS	7.4	6.5	5.9	4.9	4.5	3.3	4.1	3.4
Total1-a	17.6	22.0	24.0	22.1	22.6	21.9	22.6	20.8
Total1-b	12.8	19.9	23.2	21.8	22.7	22.1	23.0	21.1
A.2. Investment								
BGFIR	3.8	6.5	6.0	4.5	3.9	3.1	3.1	2.1
BGFINR	6.5	9.3	7.6	7.9	7.5	7.9	6.5	6.9
BGFIME	4.3	11.2	14.0	12.5	11.1	10.6	11.3	11.9
Total2-a	17.1	24.3	24.6	24.1	21.7	24.3	19.0	19.7
Total2-b	14.6	27.0	27.6	24.9	22.5	21.6	21.0	21.0
A.3. Inventories								
INVNF	-12.2	-7.5	-3.8	-3.9	-2.4	-2.0	-3.2	1.0
Total3-a	-13.5	-8.4	-4.2	-4.4	-3.0	-2.6	-3.6	0.6
A.4. Imports & Exports								
IM	16.8	19.4	8.6	9.7	12.7	9.3	9.0	5.8

.... Continued Table 5.7

X	55.6	32.5	36.5	39.3	34.2	37.0	34.4	35.6
Total4-a	74.2	52.5	45.3	49.6	46.8	46.4	44.7	41.9
Total4-b	72.4	51.9	45.1	48.9	46.9	46.4	43.4	41.4
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	95.0	92.0	92.1	92.9	88.4	87.7	85.2	84.3
Total5-b	86.3	90.4	91.7	91.2	89.1	87.4	83.8	84.0
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	3.5	3.8	2.7	0.8	3.2	1.1	1.7	0.6
B.2. Other components of Public Sector								
OG	-0.5	1.1	0.6	0.2	0.5	0.6	0.6	0.4
Total Contribution of Public Sector								
Total6-a	3.0	4.8	3.3	1.0	3.7	1.6	2.3	1.0
Total6-b	3.0	4.9	3.3	1.0	3.7	1.7	2.3	1.0
C. Financial Sector								
C.1. Exchange Rate								
ER	-0.0	-0.3	-0.2	-0.5	-0.4	-0.5	-0.4	-0.1
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	1.0	1.6	2.2	1.6	1.5	1.9	2.1	2.2
C.3. High Powered Money								
HM	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
Total Contribution of Financial Sector								
Total7-a	1.0	1.2	1.8	1.0	0.9	1.2	1.4	1.8
Total7-b	1.0	1.3	1.8	1.0	0.9	1.2	1.4	1.8

.... Continued Table 5.7

D. Prices & Income								
D.1. GDP Deflator								
P	-0.1	-0.0	-0.1	-0.2	0.0	0.2	0.7	1.1
D.2. Nominal Wages								
W	0.5	0.7	0.6	0.6	0.8	1.0	1.2	1.7
D.3. Price of Imports								
PIM	-0.1	-0.6	-1.4	-0.8	-0.4	0.3	0.3	0.9
D.4. Labour & Non-Labour Income								
PI	0.0	-0.1	-0.2	-0.3	-0.4	-0.8	-0.8	-0.9
D.5. Corporate profits								
NCPROF	0.0	1.3	3.0	4.5	5.6	7.1	7.9	8.0
Total Contribution of Prices & Income								
Total8-a	0.5	1.3	1.9	3.8	5.6	7.8	9.2	10.9
Total8-b	0.5	1.3	1.9	3.8	5.6	7.8	9.2	10.9
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.3	0.4	0.6	1.0	1.0	1.2	1.4	1.5
Total Contribution of Unemployment & Labour Force								
Total9-a	0.6	0.6	0.9	1.3	1.4	1.7	1.8	2.0
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0

* VCV matrix is not assumed to be Block Diagonal.

TABLE 5.8

Variance Decomposition For Rate of Inflation

METHOD 3 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.1	0.0	0.2	0.6	0.7	0.6	0.5
CND	0.0	-0.1	0.1	0.2	0.2	0.1	0.2	0.2
CSD	0.0	0.1	0.2	0.1	0.3	0.2	0.2	0.2
CS	0.0	0.3	0.7	1.1	1.3	1.3	1.2	1.3
Total1-a	0.0	0.3	1.0	1.6	2.4	2.2	2.1	2.1
Total1-b	0.0	0.2	0.9	1.6	2.3	2.2	2.1	2.1
A.2. Investment								
BGFIR	0.0	0.6	1.4	1.8	1.8	1.6	1.6	1.5
BGFINR	0.0	0.1	0.3	0.5	0.8	1.0	1.4	1.6
BGFIME	0.0	0.2	0.6	1.0	2.0	2.4	2.8	2.9
Total2-a	0.0	0.9	2.3	3.2	4.5	5.0	5.7	5.9
Total2-b	0.0	0.9	2.3	3.2	4.5	5.0	5.7	5.9
A.3. Inventories								
INVNF	0.0	0.7	0.3	-0.9	-1.1	-1.1	-1.5	-1.6
Total3-a	0.0	0.7	0.3	-1.0	-1.2	-1.2	-1.5	-1.6
A.4. Imports & Exports								
IM	0.0	0.4	1.6	2.3	2.5	4.1	4.0	4.6

.... Continued Table 5.8

X	0.0	-1.4	-1.4	0.1	3.0	2.8	3.6	4.1
Total4-a	0.0	-1.2	-0.1	2.2	5.3	6.9	7.6	8.6
Total4-b	0.0	-1.0	0.2	2.4	5.4	6.9	7.6	8.7
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	0.4	3.3	6.0	11.0	12.9	13.9	15.1
Total5-b	0.0	0.8	3.6	6.2	11.0	13.0	14.0	15.0
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-0.5	-0.5	-0.4	-0.8	-0.7	-0.6	-0.7
B.2. Other components of Public Sector								
OG	0.0	-0.1	-0.1	0.0	0.0	0.2	0.4	0.5
Total Contribution of Public Sector								
Total6-a	0.0	-0.5	-0.7	-0.4	-0.8	-0.6	-0.3	-0.2
Total6-b	0.0	-0.5	-0.6	-0.4	-0.8	-0.5	-0.3	-0.3
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.4	-0.6	0.2	4.3	10.0	13.1	16.8
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	2.6	4.3	8.0	13.8	18.2	21.5	25.9	27.5
C.3. High Powered Money								
HM	0.0	0.8	-0.3	-1.3	-1.0	0.2	1.7	2.9
Total Contribution of Financial Sector								
Total7-a	2.6	4.6	7.1	12.8	21.5	31.7	40.7	47.2
Total7-b	2.6	4.6	7.2	12.8	21.5	31.7	40.7	47.2

.... Continued Table 5.8

D. Prices & Income

D.1. GDP Deflator								
P	97.5	94.5	88.8	80.3	67.2	54.6	44.8	37.5
D.2. Nominal Wages								
W	0.0	0.8	0.9	0.5	0.2	0.3	-0.4	-0.6
D.3. Price of Imports								
PIM	0.0	0.2	0.4	0.6	0.4	-0.2	-0.3	-0.7
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.1	0.2	0.4	0.4	0.6
D.5. Corporate profits								
NCPROF	0.0	0.0	0.1	0.4	1.0	1.2	1.6	1.8
Total Contribution of Prices & Income								
Total8-a	97.5	95.4	90.3	81.8	68.8	56.3	46.0	38.4
Total8-b	97.5	95.4	90.2	81.8	68.9	56.2	46.0	38.5
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.0	-0.1	-0.3	-0.5	-0.5	-0.6	-0.6
Total Contribution of Unemployment & Labour Force								
Total9-a	0.0	0.0	-0.1	-0.2	-0.4	-0.4	-0.4	-0.4
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.1	100.0	99.9	100.0

TABLE 5.9

Variance Decomposition For Rate of Inflation

METHOD 3 (Fair's Technique)*

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.0	0.1	0.1	0.3	0.4	0.6	0.6
CND	0.0	-0.2	-0.2	0.0	0.2	0.4	0.2	0.5
CSD	0.0	0.1	0.1	0.2	0.3	0.2	0.3	0.2
CS	0.0	0.3	0.6	0.7	1.1	1.0	1.1	1.0
Total1-a	0.0	0.2	0.8	1.2	2.0	2.1	2.3	2.2
Total1-b	0.0	0.1	0.6	1.0	1.9	2.0	2.3	2.3
A.2. Investment								
BGFIR	0.0	0.5	1.4	1.5	1.7	1.9	1.8	1.6
BGFINR	0.0	-0.1	0.3	0.5	1.1	1.3	1.2	0.6
BGFIME	0.0	0.0	0.2	0.5	1.2	1.3	1.3	1.2
Total2-a	0.0	0.9	2.4	3.3	4.2	5.1	5.7	5.9
Total2-b	0.0	0.5	1.9	2.5	4.1	4.5	4.3	3.5
A.3. Inventories								
INVNF	0.0	1.1	1.0	0.7	-0.8	-1.4	-0.8	-2.0
Total3-a	0.0	1.1	0.9	0.7	-0.8	-1.5	-0.9	-2.2
A.4. Imports & Exports								
IM	0.0	-1.1	-0.7	0.8	1.1	2.1	2.5	3.7

.... Continued Table 5.9

X	0.0	-0.2	0.7	0.2	2.1	3.1	3.5	5.0
Total4-a	0.0	-1.2	-0.1	1.0	3.2	5.2	6.0	8.8
Total4-b	0.0	-1.2	-0.1	1.0	3.2	5.2	6.0	8.7
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	0.5	3.5	5.3	8.4	10.3	11.7	12.4
Total5-b	0.0	0.4	3.4	5.2	8.4	10.3	11.7	12.3
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-0.3	-0.7	-0.6	-0.7	-0.8	-0.8	-0.7
B.2. Other components of Public Sector								
OG	0.0	-0.1	0.1	0.1	0.0	0.0	-0.0	0.0
Total Contribution of Public Sector								
Total6-a	0.0	-0.3	-0.6	-0.5	-0.6	-0.8	-0.9	-0.7
Total6-b	0.0	-0.3	-0.6	-0.5	-0.6	-0.8	-0.9	-0.7
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.3	-0.5	0.9	3.7	7.3	11.1	14.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	3.5	4.2	6.8	11.0	17.4	21.7	26.7	29.2
C.3. High Powered Money								
HM	0.0	0.5	-0.1	-0.5	-0.7	-0.0	1.0	2.6
Total Contribution of Financial Sector								
Total7-a	3.5	4.5	6.2	11.5	20.4	28.9	38.9	46.2
Total7-b	3.5	4.5	6.2	11.5	20.4	28.9	38.8	46.2

.... Continued Table 5.9

D. Prices & Income								
D.1. GDP Deflator								
P	96.5	93.3	89.3	82.0	70.1	59.7	48.5	40.1
D.2. Nominal Wages								
W	0.0	1.8	1.3	1.4	1.2	1.3	0.8	1.0
D.3. Price of Imports								
PIM	0.0	0.1	0.2	0.3	0.2	-0.0	-0.1	-0.6
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.3
D.5. Corporate profits								
NCPROF	0.0	0.0	0.0	0.1	0.4	0.7	1.4	1.8
Total Contribution of Prices & Income								
Total8-a	96.5	95.3	91.0	83.9	72.1	62.0	50.7	42.6
Total8-b	96.5	95.3	91.0	83.9	72.1	62.0	50.8	42.6
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.6
Total Contribution of Unemployment & Labour Force								
Total9-a	0.0	0.0	-0.1	-0.1	-0.3	-0.4	-0.5	-0.5
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* VCV matrix is not assumed to be Block Diagonal.

TABLE 5.10

Variance Decomposition For Rate of Unemployment

METHOD 3 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.2	0.6	1.4	2.4	3.1	3.7	4.2
CND	0.0	0.9	1.4	1.7	1.9	2.0	1.9	2.2
CSD	0.0	0.5	0.7	1.0	1.2	1.3	1.3	1.5
CS	0.0	0.7	1.4	1.7	2.0	2.2	2.5	2.8
Total1-a	0.0	1.9	3.9	5.7	7.3	8.4	9.2	10.5
Total1-b	0.0	1.9	4.0	5.7	7.3	8.5	9.4	10.6
A.2. Investment								
BGFIR	0.0	1.0	2.0	2.3	2.4	2.2	2.0	1.9
BGFINR	0.0	0.9	1.5	1.5	2.3	2.6	2.8	3.1
BGFIME	0.0	2.0	3.1	4.0	5.4	6.3	7.2	7.7
Total2-a	0.0	3.8	6.5	7.8	10.0	11.0	11.9	12.6
Total2-b	0.0	3.9	6.5	7.8	10.0	11.1	12.0	12.6
A.3. Inventories								
INVNF	0.0	-1.1	-1.7	-2.8	-3.1	-3.3	-3.2	-4.3
Total3-a	0.0	-1.1	-1.7	-2.9	-3.3	-3.7	-3.7	-4.9
A.4. Imports & Exports								
IM	0.0	-5.3	-7.6	-7.6	-9.3	-9.1	-9.5	-8.9

.... Continued Table 5.10

X	0.0	6.5	10.4	12.9	16.9	18.0	20.2	23.5
Total4-a	0.0	1.1	2.8	5.3	7.7	9.0	11.1	15.1
Total4-b	0.0	1.3	2.8	5.3	7.6	8.9	10.7	14.7
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	5.7	11.6	16.0	21.7	24.9	28.5	33.1
Total5-b	0.0	5.9	11.7	15.9	21.6	24.7	28.3	33.0
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-0.8	-1.0	-1.2	-1.4	-1.3	-1.3	-1.2
B.2. Other components of Public Sector								
OG	0.0	-0.2	-0.2	-0.2	-0.2	0.2	0.3	0.3
Total Contribution of Public Sector								
Total6-a	0.0	-0.9	-1.2	-1.3	-1.6	-1.2	-1.1	-0.9
Total6-b	0.0	-0.9	-1.2	-1.3	-1.5	-1.1	-1.1	-0.9
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	0.0	-0.1	-0.1	-0.1	0.1	0.1	0.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.0	-0.2	-0.3	-0.5	-0.9	-0.9	-1.0	-1.2
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
Total Contribution of Financial Sector								
Total7-a	0.0	-0.2	-0.4	-0.7	-1.0	-0.8	-0.9	-0.9
Total7-b	0.0	-0.2	-0.4	-0.6	-1.0	-0.9	-0.9	-0.9

.... Continued Table 5.10

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
D.2. Nominal Wages								
W	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
D.3. Price of Imports								
PIM	0.0	0.0	0.1	0.1	0.1	0.0	0.0	-0.2
D.4. Labour & Non-Labour Income								
PI	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.5	-0.7
D.5. Corporate profits								
NCPROF	0.0	0.0	0.2	0.5	1.0	1.6	2.1	2.8
Total Contribution of Prices & Income								
Total8-a	0.0	0.0	0.3	0.5	1.1	1.6	2.3	2.8
Total8-b	0.0	0.0	0.3	0.5	1.1	1.6	2.3	2.8
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	95.3	89.7	85.4	79.6	75.3	71.0	65.6
Total Contribution of Unemployment & Labour Force								
Total9-a	100.0	95.3	89.8	85.5	79.8	75.5	71.2	65.8
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.1	100.0	100.0	100.1	100.0	99.9

TABLE 5.11

Variance Decomposition For Rate of Unemployment

METHOD 3 (Fair's Technique)*

Quarters Ahead	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.2	0.5	1.3	2.0	3.0	4.0	4.8
CND	0.0	0.6	0.9	1.1	1.6	2.1	2.5	2.7
CSD	0.0	0.3	0.5	0.8	1.1	1.4	1.6	1.7
CS	0.0	0.4	1.0	1.8	2.0	2.3	2.3	2.5
Total1-a	0.0	1.3	3.1	5.2	6.9	8.8	10.3	11.6
Total1-b	0.0	1.1	2.9	5.0	6.7	8.7	10.3	11.7
A.2. Investment								
BGFIR	0.0	0.6	1.2	2.0	2.4	2.5	2.3	2.4
BGFINR	0.0	0.8	1.6	2.0	2.5	3.1	3.6	3.9
BGFIME	0.0	1.8	3.2	5.0	6.0	7.3	7.7	7.9
Total2-a	0.0	3.8	6.5	7.7	10.2	11.3	11.9	12.4
Total2-b	0.0	3.2	6.0	9.0	11.0	12.9	13.6	14.2
A.3. Inventories								
INVNF	0.0	-0.2	-1.2	-1.6	-3.5	-4.3	-5.1	-5.6
Total3-a	0.0	-0.4	-1.6	-2.1	-4.0	-5.0	-5.8	-6.3
A.4. Imports & Exports								
IM	0.0	-6.7	-8.7	-9.8	-10.7	-10.0	-8.2	-7.6

.... Continued Table 5.11

X	0.0	6.9	9.3	12.1	16.3	19.2	20.8	22.2
Total4-a	0.0	0.1	0.6	2.2	5.5	9.0	12.4	14.4
Total4-b	0.0	0.2	0.5	2.3	5.6	9.2	12.6	14.5
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	4.2	7.9	14.0	19.2	25.5	30.2	33.4
Total5-b	0.0	4.2	7.8	14.1	19.4	25.8	30.7	34.0
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-0.8	-1.2	-1.4	-1.3	-1.3	-1.0	-0.9
B.2. Other components of Public Sector								
OG	0.0	-0.2	-0.1	-0.1	-0.1	-0.0	0.1	0.1
Total Contribution of Public Sector								
Total6-a	0.0	-1.0	-1.3	-1.5	-1.3	-1.3	-0.9	-0.8
Total6-b	0.0	-1.0	-1.3	-1.5	-1.3	-1.3	-0.9	-0.8
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.0	-0.2	-0.4	-0.4	-0.7	-0.8	-0.8	-0.9
C.3. High Powered Money								
HM	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1
Total Contribution of Financial Sector								
Total7-a	0.0	-0.2	-0.5	-0.5	-0.9	-1.0	-1.0	-1.1
Total7-b	0.0	-0.2	-0.5	-0.5	-0.9	-1.0	-1.0	-1.1

.... Continued Table 5.11

D. Prices & Income

D.1. GDP Deflator

P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

D.2. Nominal Wages

W	0.0	0.0	0.1	0.2	0.3	0.4	0.5	0.7

D.3. Price of Imports

PIM	0.0	0.0	0.0	-0.0	-0.1	-0.2	-0.1	0.1

D.4. Labour & Non-Labour Income

PI	0.0	-0.1	-0.2	-0.4	-0.5	-0.6	-0.8	-1.0

D.5. Corporate profits

NCPROF	0.0	0.0	0.2	0.6	1.1	1.7	2.5	3.4

Total Contribution of Prices & Income

Total8-a	0.0	-0.0	0.1	0.4	0.8	1.3	2.2	3.3
Total8-b	0.0	-0.0	0.1	0.4	0.8	1.3	2.2	3.3

E. Unemplotment & Labour Force

E.1. Unemployment Rate

UNR	100.0	96.9	93.7	87.6	82.0	75.4	69.3	65.0

Total Contribution of Unemployment & Labour Force

Total9-a	100.0	97.0	93.8	87.7	82.1	75.5	69.5	65.2

Grand Total of all individual Totals

Total-c	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* VCV matrix is not assumed to be Block Diagonal.

TABLE 5.12

Variance Decomposition For Real GDP

METHOD 1 (Fair's Technique)*

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	-3.7	7.9	14.1	13.2	16.0	16.8	16.7	16.8
CND	4.6	4.9	6.0	6.0	6.6	6.8	7.5	5.5
CSD	7.8	6.7	6.2	6.3	5.4	5.6	5.2	5.2
CS	8.4	8.5	8.0	6.9	6.2	4.2	6.0	4.9
Total1-a	13.8	23.2	28.8	26.8	29.4	28.0	30.1	27.7
Total1-b	17.1	28.1	34.4	32.4	34.2	33.5	35.4	32.4
A.2. Investment								
BGFIR	-1.7	6.1	6.8	4.8	4.5	3.3	3.4	1.7
BGFINR	-3.2	5.8	4.4	5.9	5.9	6.6	5.2	6.6
BGFIME	-11.9	4.9	11.7	10.8	8.8	7.4	9.5	11.0
Total2-a	-28.5	2.9	6.6	12.5	10.6	14.8	7.9	10.7
Total2-b	-16.7	16.8	22.8	21.5	19.2	17.3	18.1	19.3
A.3. Inventories								
INVNF	-213.9	-117.5	-75.3	-60.3	-49.4	-46.5	-41.6	-32.4
Total3-a	-219.0	-120.4	-78.7	-63.2	-51.6	-48.6	-43.8	-34.3
A.4. Imports & Exports								
IM	-156.6	-91.3	-83.3	-66.5	-54.9	-57.9	-52.3	-54.4

.... Continued Table 5.12

X	-79.3	-60.8	-27.7	-12.8	-9.3	-3.0	-1.8	3.3
Total4-a	-69.9	-32.9	-9.7	3.8	5.2	11.3	10.3	12.8
Total4-b	-235.9	-152.1	-111.0	-79.3	-64.2	-61.0	-54.1	-51.1
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	84.8	88.4	89.9	91.1	89.5	88.0	86.5	85.3
Total5-b	-454.4	-227.6	-132.5	-88.7	-62.4	-58.8	-44.4	-33.7
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	-3.9	0.5	0.5	-2.2	2.9	-1.2	0.3	-1.6
B.2. Other components of Public Sector								
OG	-2.3	1.1	0.1	-0.6	-0.0	0.1	0.1	-0.4
Total Contribution of Public Sector								
Total6-a	-7.8	0.5	-0.2	-3.3	2.4	-1.6	-0.1	-2.4
Total6-b	-6.2	1.6	0.6	-2.8	2.9	-1.1	0.5	-1.9
C. Financial Sector								
C.1. Exchange Rate								
ER	-0.2	-1.1	-1.3	-2.1	-2.2	-2.6	-2.8	-2.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	1.5	2.1	2.5	0.9	0.0	0.1	0.1	-0.3
C.3. High Powered Money								
HM	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.5	-0.5
Total Contribution of Financial Sector								
Total7-a	1.3	0.8	1.1	-1.3	-2.4	-2.9	-3.0	-2.9
Total7-b	1.3	0.8	1.0	-1.4	-2.6	-3.0	-3.2	-3.2

.... Continued Table 5.12

D. Prices & Income

D.1. GDP Deflator

P	-0.1	-0.1	-0.3	-0.4	-0.0	0.3	1.1	1.9

D.2. Nominal Wages

W	1.0	1.4	1.1	1.2	1.4	1.6	1.8	2.8

D.3. Price of Imports

PIM	-0.4	-1.9	-4.0	-3.5	-3.4	-3.5	-4.9	-5.1

D.4. Labour & Non-Labour Income

PI	-0.1	-0.4	-0.7	-1.1	-1.4	-2.2	-2.4	-2.8

D.5. Corporate profits

NCPROF	0.0	2.4	5.2	7.5	9.2	11.6	12.6	12.6

Total Contribution of Prices & Income

Total8-a	0.6	1.5	1.6	4.2	6.2	8.3	8.9	10.2
Total8-b	0.5	1.4	1.3	3.8	5.6	7.7	8.2	9.3

E. Unemplotment & Labour Force

E.1. Unemployment Rate

UNR	0.5	0.7	1.1	1.7	1.8	2.1	2.3	2.6

Total Contribution of Unemployment & Labour Force

Total9-a	1.1	1.1	1.6	2.3	2.5	2.9	3.0	3.3

Grand Total of all individual Totals

Total-c	79.8	92.3	94.1	92.9	98.1	94.6	95.3	93.5

* VCV matrix is not assumed to be Block Diagonal.

TABLE 5.13

Variance Decomposition For Real GDP

METHOD 2 (Fair's Technique)*

Quarters Ahead	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.2	3.0	3.7	3.7	3.9	3.8	3.9	3.6
CND	0.2	3.0	3.7	3.7	3.9	3.8	3.9	3.6
CSD	1.8	1.3	1.0	0.8	0.7	0.7	0.6	0.6
CS	6.3	4.5	3.7	2.9	2.7	2.4	2.3	2.0
Total1-a	21.3	20.9	19.1	17.3	15.8	15.7	15.1	13.8
Total1-b	8.6	11.7	12.1	11.2	11.1	10.7	10.7	9.7
A.2. Investment								
BGFIR	9.3	6.9	5.1	4.2	3.3	2.9	2.8	2.5
BGFINR	16.1	12.8	10.9	9.9	9.2	9.2	7.9	7.3
BGFIME	20.5	17.5	16.4	14.2	13.4	13.7	13.2	12.9
Total2-a	62.0	46.7	43.2	37.6	33.2	32.7	30.1	28.8
Total2-b	45.8	37.2	32.3	28.3	25.8	25.8	23.8	22.7
A.3. Inventories								
INVNF	189.6	102.6	67.7	52.5	44.5	42.5	35.2	34.4
Total3-a	191.9	103.6	70.2	54.4	45.6	43.5	36.6	35.5
A.4. Imports & Exports								
IM	190.3	130.1	100.4	85.9	80.3	76.6	70.4	66.1

.... Continued Table 5.13

X	190.4	125.9	100.8	91.3	77.8	77.1	70.6	67.8
Total4-a	218.3	138.0	100.3	95.4	88.4	81.6	79.0	71.0
Total4-b	380.7	256.0	201.2	177.2	158.1	153.7	141.0	133.9
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	105.3	95.6	94.3	94.7	87.3	87.3	83.8	83.2
Total5-b	627.1	408.4	315.9	271.1	240.6	233.7	212.1	201.8
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	10.9	7.1	4.8	3.8	3.5	3.3	3.1	2.8
B.2. Other components of Public Sector								
OG	1.2	1.1	1.1	1.0	1.0	1.1	1.1	1.2
Total Contribution of Public Sector								
Total6-a	13.8	9.2	6.7	5.3	5.0	4.9	4.8	4.5
Total6-b	12.1	8.1	5.9	4.9	4.4	4.4	4.2	4.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.2	0.5	0.8	1.1	1.4	1.7	2.0	2.1
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.5	1.2	1.8	2.3	2.9	3.7	4.1	4.7
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Contribution of Financial Sector								
Total7-a	0.6	1.7	2.6	3.3	4.2	5.2	5.9	6.5
Total7-b	0.7	1.7	2.7	3.4	4.4	5.4	6.1	6.8

.... Continued Table 5.13

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4
D.2. Nominal Wages								
W	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.7
D.3. Price of Imports								
PIM	0.3	0.7	1.1	1.9	2.7	4.0	5.5	7.0
D.4. Labour & Non-Labour Income								
PI	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.0
D.5. Corporate profits								
NCPROF	0.0	0.3	0.8	1.4	2.1	2.7	3.1	3.5
Total Contribution of Prices & Income								
Total8-a	0.4	1.1	2.1	3.5	5.1	7.4	9.5	11.6
Total8-b	0.5	1.3	2.4	3.9	5.6	7.9	10.2	12.6
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.1	0.1	0.2	0.3	0.4	0.4	0.5
Total Contribution of Unemployment & Labour Force								
Total9-a	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6
Grand Total of all individual Totals								
Total-c	120.2	107.7	105.9	107.1	101.9	105.3	104.6	106.4

* VCV matrix is not assumed to be Block Diagonal.

TABLE 5.14

Variance Decomposition For Real GDP

METHOD 1 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	-3.9	9.4	13.2	14.4	15.3	14.2	15.2	16.0
CND	6.1	4.6	8.3	5.4	5.4	5.2	2.1	4.1
CSD	8.8	5.9	6.4	5.5	5.1	5.1	3.4	4.2
CS	12.2	10.7	9.0	7.3	5.6	7.0	6.3	5.7
Total1-a	19.5	24.8	30.5	27.8	26.4	26.5	22.9	25.5
Total1-b	23.2	30.6	36.8	32.6	31.3	31.5	27.0	30.0
A.2. Investment								
BGFIR	-1.7	6.8	7.2	5.7	3.2	3.7	1.6	3.3
BGFINR	-7.3	2.2	2.9	3.5	4.1	4.8	4.1	4.5
BGFIME	-3.2	3.9	8.3	10.1	11.1	14.7	8.9	9.6
Total2-a	-28.7	2.0	6.3	10.4	10.4	15.3	7.9	10.8
Total2-b	-12.1	13.0	18.4	19.3	18.4	23.1	14.7	17.4
A.3. Inventories								
INVNF	-177.2	-113.9	-69.3	-60.5	-55.2	-35.4	-30.3	-33.5
Total3-a	-180.1	-115.4	-70.5	-63.7	-56.6	-36.0	-31.6	-34.9
A.4. Imports & Exports								
IM	-165.0	-95.4	-61.8	-63.7	-53.1	-54.1	-49.4	-42.8

.... Continued Table 5.14

X	-74.5	-48.0	-18.8	-15.1	-13.0	-7.6	-6.3	-2.4
Total4-a	-72.2	-34.1	-2.0	1.1	2.8	5.5	10.7	16.2
Total4-b	-239.4	-143.5	-80.7	-78.8	-66.1	-61.7	-55.7	-45.3
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	85.2	88.4	90.5	89.6	88.6	87.8	86.1	84.7
Total5-b	-408.4	-215.3	-96.0	-90.6	-73.0	-43.1	-45.6	-32.8
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	-8.8	-2.4	-3.0	-3.0	0.2	-0.9	-0.9	-0.9
B.2. Other components of Public Sector								
OG	-2.5	-1.5	-0.6	-0.0	0.7	0.4	-0.1	-1.1
Total Contribution of Public Sector								
Total6-a	-12.7	-4.8	-4.1	-3.5	0.4	-0.7	-1.3	-2.2
Total6-b	-11.3	-3.9	-3.6	-3.0	0.9	-0.5	-1.0	-2.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.3	-0.5	-0.6	-0.1	-1.8	-1.5	-0.6	-1.7
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.8	1.8	1.0	1.1	1.3	0.4	1.2	-0.4
C.3. High Powered Money								
HM	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	-0.4	-0.4
Total Contribution of Financial Sector								
Total7-a	1.1	1.2	0.3	0.8	-0.7	-1.4	0.4	-2.2
Total7-b	1.0	1.2	0.2	0.7	-0.9	-1.6	0.2	-2.5

.... Continued Table 5.14

D. Prices & Income								
D.1. GDP Deflator								
P	-0.1	-0.2	-0.2	-0.3	-0.0	0.6	0.8	1.2
D.2. Nominal Wages								
W	1.0	1.4	1.3	1.2	1.3	1.2	1.7	2.1
D.3. Price of Imports								
PIM	0.1	-0.9	-1.4	-2.9	-2.8	-2.0	-4.7	-3.3
D.4. Labour & Non-Labour Income								
PI	0.3	-0.5	-0.9	-1.1	-1.1	-1.3	-1.4	-2.0
D.5. Corporate profits								
NCPROF	0.0	2.5	4.6	6.5	8.0	10.1	10.3	12.8
Total Contribution of Prices & Income								
Total8-a	1.4	2.3	3.4	3.4	5.8	9.0	7.6	11.6
Total8-b	1.3	2.3	3.4	3.3	5.5	8.6	6.8	10.7
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.8	1.4	1.6	2.0	2.0	2.3	2.4	2.9
Total Contribution of Unemployment & Labour Force								
Total9-a	1.4	2.1	2.3	2.7	2.7	2.9	3.0	3.6
Grand Total of all individual Totals								
Total-c	76.3	89.3	92.4	93.0	96.7	97.6	95.8	95.5

TABLE 5.15

Variance Decomposition For Real GDP

METHOD 2 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.2	3.1	3.7	4.0	4.0	3.7	3.9	3.9
CND	10.4	6.9	5.0	4.1	3.9	3.4	3.1	3.0
CSD	1.9	1.2	1.0	0.8	0.7	0.7	0.6	0.6
CS	6.9	4.5	3.2	3.0	2.6	2.5	2.1	2.2
Total1-a	23.7	21.8	19.3	17.0	16.4	15.3	14.0	14.1
Total1-b	19.4	15.8	12.9	12.0	11.2	10.3	9.8	9.6
A.2. Investment								
BGFIR	9.7	6.6	5.1	3.9	3.2	2.8	2.6	2.4
BGFINR	15.2	11.9	10.5	9.4	8.5	8.1	7.3	6.6
BGFIME	20.4	16.7	15.2	15.3	13.4	13.7	13.4	13.1
Total2-a	63.0	46.7	43.0	37.7	33.1	32.6	30.2	28.7
Total2-b	45.2	35.1	30.7	28.5	25.1	24.6	23.3	22.1
A.3. Inventories								
INVNF	168.2	104.5	64.6	56.8	48.8	38.1	40.3	33.9
Total3-a	169.5	106.1	65.6	58.8	49.9	38.8	41.3	34.8
A.4. Imports & Exports								
IM	177.3	122.0	86.1	84.5	82.5	69.2	70.0	63.4

.... Continued Table 5.15

X	198.7	123.6	90.3	90.9	80.8	73.7	71.5	68.4
Total4-a	203.5	135.5	96.2	94.9	93.6	75.1	74.3	70.8
Total4-b	375.9	245.7	176.4	175.4	163.3	142.9	141.5	131.8
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	109.3	98.7	96.4	93.8	87.7	85.0	83.8	81.3
Total5-b	610.1	402.6	285.7	274.7	249.6	216.6	215.8	198.4
B. <u>Public Sector</u>								
B.1. Government Expenditure on Goods & Services								
G	10.8	7.1	4.6	4.1	3.6	3.1	3.0	2.8
B.2. Other components of Public Sector								
OG	1.1	1.1	1.0	1.1	1.2	1.1	1.2	1.3
Total Contribution of Public Sector								
Total6-a	13.4	9.1	6.2	5.7	5.3	4.5	4.4	4.2
Total6-b	12.0	8.2	5.7	5.2	4.7	4.2	4.2	4.0
C. <u>Financial Sector</u>								
C.1. Exchange Rate								
ER	0.2	0.5	0.8	1.3	1.7	1.9	2.2	2.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT'	0.4	1.1	1.8	2.3	3.0	3.6	4.2	4.7
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Contribution of Financial Sector								
Total7-a	0.6	1.6	2.5	3.5	4.6	5.4	6.2	6.9
Total7-b	0.6	1.6	2.6	3.6	4.7	5.6	6.5	7.1

.... Continued Table 5.15

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4
D.2. Nominal Wages								
W	0.0	0.1	0.1	0.1	0.2	0.3	0.5	0.7
D.3. Price of Imports								
PIM	0.3	0.6	1.1	1.9	2.9	3.9	5.5	6.9
D.4. Labour & Non-Labour Income								
PI	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.0
D.5. Corporate profits								
NCPROF	0.0	0.3	0.8	1.4	2.0	2.4	2.9	3.4
Total Contribution of Prices & Income								
Total8-a	0.4	1.2	2.3	3.9	5.5	7.1	9.4	11.5
Total8-b	0.4	1.3	2.4	3.9	5.8	7.6	10.1	12.4
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.5
Total Contribution of Unemployment & Labour Force								
Total9-a	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6
Grand Total of all individual Totals								
Total-c	123.6	110.7	107.6	107.1	103.3	102.5	104.3	104.5

TABLE 5.16

Top Six Contributors to the Variance of GDP

(Based on METHOD 3)

	Quarter 1	Quarter 4	Quarter 8
		Bootstrapping	
1.	X(62.1)	X(37.9)	X(33.0)
2.	CS(9.6)	BGFIME(12.7)	BGFIME(11.3)
3.	BGFIME(8.6)	IM(10.4)	IM(10.3)
4.	CND(8.3)	CD(9.2)	CD(9.9)
5.	IM(6.1)**	BGFINR(6.4)	NCPROF(8.1)
6.	CSD(5.3)	CS(5.1)	BGFINR(5.6)
		Fair's technique*	
1.	X(55.6)	X(39.3)	X(35.6)
2.	IM(16.8)	BGFIME(12.5)	BGFIME(11.9)
3.	CS(7.4)	IM(9.7)	CD(10.2)
4.	BGFINR(6.5)	CD(8.5)	NCPROF(8.0)
5.	CSD(4.8)	BGFINR(7.9)	BGFINR(6.9)
6.	BGFIME(4.3)	CND,CS(4.9)	IM(5.8)

* VCV matrix is not assumed to be Block Diagonal.

** Variance difference/standard error is less than 2. See tables 5A.16 and 5A.17.

TABLE 5.17

Top Five Contributors to the Variance of PDOT

(Based on METHOD 3)

	Quarter 2	Quarter 5	Quarter 8
		Bootstrapping	
1.	PDOT(94.5)	PDOT(67.2)	PDOT(37.5)
2.	NT(4.3)	NT(18.2)	NT(27.5)
3.	HM(0.8)	ER(4.3)	ER(16.8)
4.	W(0.8)**	X(3.0)	IM(4.6)
5.	INVNF(0.7)**	IM(2.5)	X(4.1)
		Fair's technique*	
1.	PDOT(93.3)	PDOT(70.1)	PDOT(40.1)
2.	NT(4.2)	NT(17.4)	NT(29.2)
3.	W(1.8)	ER(3.7)	ER(14.4)
4.	INVNF(1.1)**	X(2.1)**	X(5.0)
5.	HM,BGFIR(0.5)	BGFIR(1.7)	IM(3.7)

* VCV matrix is not assumed to be Block Diagonal.

** Variance difference/standard error is less than 2. See tables 5A.20 and 5A.21.

TABLE 5.18

Top Five Contributors to the Variance of UNR

(Based on METHOD 3)

	Quarter 2	Quarter 5	Quarter 8
		Bootstrapping	
1.	UNR(95.3)	UNR(79.6)	UNR(65.6)
2.	X(6.5)	X(16.9)	X(23.5)
3.	BGFIME(2.0)	BGFIME(5.4)	BGFIME(7.7)
4.	BGFIR(1.0)	BGFIR(2.4)	CD(4.2)
5.	BGFINR, CND(0.9)	CD(2.4)	BGFINR(3.1)
		Fair's technique*	
1.	UNR(96.9)	UNR(82.0)	UNR(65.0)
2.	X(6.9)	X(16.3)	X(22.2)
3.	BGFIME(1.8)	BGFIME(6.0)	BGFIME(7.9)
4.	BGFINR(0.8)	BGFINR(2.5)	CD(4.8)
5.	CD(0.6)	BGFIR(2.4)	BGFINR(3.9)

* VCV matrix is not assumed to be Block Diagonal.

Appendix 5A

GENERAL NOTES

- All the tables in this appendix are based on 1000 trials, unless otherwise specified.

- VCV matrix is not assumed to be block diagonal, for tables based on Fair's technique.

- Each number in tables 5A.1 to 5A.15, shows the contribution of the corresponding shock as a percentage of the total variance of the relevant variable (GDP, PDOT or UNR).

- For tables reporting the Precision of the stochastic simulation estimates based on METHOD 3 (both bootstrapping and Fair's technique), the first number is $\hat{\eta}_{it}(g)$,

the second number is, $[\hat{var}[\hat{\eta}_{it}(g)]]^{1/2}$ *and the last number is* ζ_3 .

TABLE 5A.1

Variance Decomposition For Real GDP

METHOD 3 (Fair's Technique)

Shocks	Quarters Ahead 1	2	3	4	5	6	7	8
CD	-1.1	7.5	6.3	8.6	11.4	11.2	10.4	12.8
CND	-0.0	3.9	5.5	5.8	5.2	7.2	6.2	6.8
CSD	4.0	4.5	2.9	3.8	3.4	4.0	3.0	3.2
CS	7.5	9.2	8.3	6.6	6.3	3.8	4.9	2.6
BGFIR	8.8	9.2	5.2	3.3	4.9	3.6	4.2	2.6
BGFINR	9.0	10.2	5.5	6.4	6.2	6.4	6.8	5.2
BGFIME	0.3	18.3	15.2	14.0	17.5	10.1	10.3	8.1
INVNF	-12.7	-10.3	-3.7	-5.0	-7.9	7.6	-11.4	4.9
IM	30.8	27.0	6.9	7.7	19.9	4.2	15.0	14.9
NTR	-0.4	-0.6	-0.5	-0.3	-0.0	-0.3	-0.4	-0.6
NPTX	-0.7	-0.8	-0.4	-0.8	-1.1	-0.6	-1.2	-1.3
NCTX	0.0	0.7	1.1	1.5	1.9	2.3	1.9	2.4
NS	0.1	0.2	0.5	0.3	0.5	0.6	0.5	0.5
UNR	0.3	0.6	0.9	1.5	2.0	2.0	1.7	2.0
W	0.5	0.6	0.4	0.3	0.2	-0.0	0.7	1.3
NLI	0.4	0.8	0.8	1.0	0.7	0.6	0.5	1.0
NNLI	-0.9	-0.9	-0.6	-0.9	-0.7	-1.1	-1.5	-1.3
NCPROF	0.0	1.3	2.4	4.1	6.4	8.7	8.6	9.4
ER	-0.2	-1.2	-0.6	-0.0	-0.7	-1.1	-1.3	-0.9
NINT	1.7	2.1	2.4	2.2	2.6	2.4	2.9	2.8
HM	0.0	-0.0	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2
P	-0.0	0.0	-0.1	-0.2	-0.1	0.1	0.2	0.5
NINTUS	-0.5	-0.9	-1.3	-1.0	-1.2	-1.2	0.0	-1.1
G	7.1	1.8	4.4	1.0	4.0	-0.4	4.2	1.7
X	43.2	19.6	38.0	39.1	23.2	28.2	33.3	24.2
PIM	0.9	0.4	-0.7	-1.1	-1.5	-0.6	0.4	0.5
PINV	0.2	0.2	-0.1	-0.1	-0.0	-0.0	0.0	0.1
PGFI	0.3	-0.4	0.6	-0.2	0.3	0.2	0.5	-0.2
INVF	-3.4	-1.3	-0.3	-0.2	0.6	0.7	-0.3	-1.1
PKAP	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	-0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.2

Variance Decomposition For Real GDP

METHOD 3 (Bootstrapping)

Quarters Ahead

Shocks	1	2	3	4	5	6	7	8
CD	-1.5	9.2	9.8	9.0	9.5	12.1	11.0	10.3
CND	10.2	5.4	5.7	3.6	4.3	3.9	3.0	2.3
CSD	4.5	4.1	5.4	2.1	2.5	2.6	1.4	1.8
CS	11.1	9.1	8.2	1.2	1.4	3.3	2.7	1.2
BGFIR	5.8	12.7	9.2	5.9	3.7	2.7	2.6	4.0
BGFINR	3.8	7.6	5.6	9.0	9.8	10.2	8.0	7.6
BGFIME	13.0	18.5	12.8	10.6	10.6	10.1	10.0	7.2
INVNF	6.2	-10.7	1.3	-19.1	-6.1	1.8	-2.5	6.4
IM	6.8	-10.9	8.1	19.4	18.0	8.1	11.3	20.8
NTR	-0.3	-0.5	-0.3	0.0	-0.4	-0.5	-0.6	-0.7
NPTX	-0.1	-0.6	-0.7	-0.2	-0.5	-0.6	-0.4	-0.8
NCTX	0.0	0.6	0.9	1.3	1.3	1.4	1.5	1.6
NS	0.3	0.4	0.5	0.5	0.4	0.3	0.4	0.4
UNR	0.2	0.9	0.9	1.1	1.3	1.6	1.5	2.1
W	0.5	0.5	0.4	0.6	0.3	0.6	1.0	1.2
NLI	1.1	0.8	0.4	0.6	1.1	0.8	0.9	1.2
NNLI	-0.2	-0.9	-0.9	-0.5	-0.7	-1.4	-1.3	-1.2
NCPROF	0.0	2.1	4.7	5.8	6.9	8.5	9.2	8.5
ER	0.3	-0.3	-1.3	-0.3	-0.2	-0.2	1.9	1.2
NINT	0.9	1.5	1.7	2.0	2.8	3.6	3.5	2.9
HM	0.0	-0.0	-0.1	-0.2	-0.2	-0.2	-0.1	-0.2
P	0.0	-0.0	0.1	-0.1	0.0	0.2	0.8	0.8
NINTUS	-0.1	-0.3	-1.8	-1.6	-1.8	-2.5	-3.0	-3.2
G	1.7	-1.4	-0.7	1.0	3.5	2.5	0.3	1.5
X	45.7	53.2	35.3	43.0	30.9	26.4	33.2	15.3
PIM	-0.3	-0.7	0.8	0.3	1.6	3.8	2.6	5.3
PINV	0.2	0.1	-0.1	0.1	-0.1	-0.0	0.1	-0.1
PGFI	1.0	0.6	1.3	2.0	2.3	1.6	1.3	0.4
INVF	-0.3	-1.0	-1.6	-0.9	-0.7	-0.3	-0.0	0.5
PKAP	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.3

Variance Decomposition For Rate of Unemployment

METHOD 3 (Fair's Method)

Quarters Ahead

Shocks	1	2	3	4	5	6	7	8
CD	0.0	-0.2	0.4	1.1	1.9	3.0	4.0	5.2
CND	0.0	0.8	0.5	0.7	0.6	1.7	2.5	2.6
CSD	0.0	0.3	0.6	0.6	1.3	1.7	1.8	2.0
CS	0.0	0.4	1.2	1.9	2.6	3.0	2.7	2.8
BGFIR	0.0	0.5	2.3	2.2	2.9	3.4	3.0	3.1
BGFINR	0.0	1.0	3.1	3.2	3.4	4.5	5.1	5.4
BGFIME	0.0	2.9	5.3	5.1	7.1	8.4	7.3	7.8
INVNF	0.0	-1.3	-4.3	-4.8	-4.1	-4.7	-2.7	-3.5
IM	0.0	-7.6	-6.5	-2.9	-6.1	-2.3	-3.5	-3.7
NTR	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
NPTX	0.0	-0.0	-0.2	-0.2	-0.4	-0.5	-0.6	-0.6
NCTX	0.0	0.0	0.1	0.3	0.5	0.8	1.0	1.3
NS	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
UNR	100.0	98.2	91.7	84.5	77.7	69.4	66.4	62.0
W	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.7
NLI	0.0	-0.1	-0.1	-0.2	-0.2	-0.1	-0.2	-0.3
NNLI	0.0	-0.1	-0.1	-0.1	-0.2	-0.5	-0.7	-1.1
NCPROF	0.0	-0.0	0.1	0.3	0.7	1.5	2.6	3.8
ER	0.0	0.0	-0.0	-0.2	-0.5	-0.2	-0.1	-0.4
NINT	0.0	0.0	0.3	0.5	0.6	0.9	1.0	1.3
HM	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0
P	0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.1	0.1
NINTUS	0.0	-0.1	-0.2	-0.4	-0.5	-0.7	-0.9	-0.9
G	0.0	-0.3	-1.2	-0.5	-0.7	0.3	0.3	0.1
X	0.0	5.6	7.7	9.4	14.0	11.6	11.4	12.5
PIM	0.0	-0.0	-0.0	-0.1	-0.0	-0.4	-0.1	0.1
PINV	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
PGFI	0.0	0.1	0.3	0.3	0.2	0.2	0.1	0.1
INVF	0.0	-0.2	-0.3	-0.3	-0.3	-0.4	-0.2	-0.2
PKAP	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.4

Variance Decomposition For Rate of Unemployment

METHOD 3 (Bootstrapping)

Quarters Ahead

Shocks	1	2	3	4	5	6	7	8
CD	0.0	-0.2	0.6	2.0	2.8	3.3	4.3	5.2
CND	0.0	0.4	0.5	0.1	0.1	0.5	0.4	1.4
CSD	0.0	0.5	1.0	1.2	1.1	1.3	1.3	1.6
CS	0.0	0.1	0.5	1.5	1.6	2.2	2.2	2.9
BGFIR	0.0	0.6	2.5	3.7	3.2	2.9	3.1	3.8
BGFINR	0.0	1.4	3.2	4.5	4.2	3.8	4.5	4.9
BGFIME	0.0	2.0	3.5	4.3	5.6	6.8	8.1	8.1
INVNF	0.0	0.4	-4.1	-4.6	-3.5	-4.5	-5.1	-7.6
IM	0.0	-6.2	-12.0	-9.9	-9.8	-9.5	-11.0	-10.6
NTR	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3
NPTX	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.3
NCTX	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.6
NS	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3
UNR	100.0	96.9	91.4	85.6	84.1	77.0	73.6	67.0
W	0.0	0.1	0.2	0.4	0.5	0.5	0.6	0.7
NLI	0.0	-0.1	-0.2	-0.4	-0.4	-0.2	-0.2	-0.1
NNLI	0.0	-0.0	-0.1	-0.1	-0.3	-0.3	-0.4	-0.6
NCPROF	0.0	0.0	0.3	1.0	1.6	2.2	3.1	3.7
ER	0.0	0.1	-0.1	-0.3	-0.6	-0.4	-0.3	-0.2
NINT	0.0	0.0	0.2	0.5	0.7	0.8	1.1	1.1
HM	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.1
P	0.0	-0.0	-0.0	0.0	0.1	0.1	0.1	0.1
NINTUS	0.0	-0.2	-0.8	-1.6	-1.9	-1.9	-2.5	-3.2
G	0.0	-0.4	-0.9	-1.4	-1.2	-0.4	-1.1	-1.5
X	0.0	5.0	14.7	13.3	11.4	15.1	17.2	21.3
PIM	0.0	-0.1	0.2	0.3	0.7	0.4	0.3	0.8
PINV	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
PGFI	0.0	0.1	0.4	0.6	0.8	1.3	1.4	1.7
INVF	0.0	-0.1	-0.6	-0.3	-0.3	-0.6	-0.6	-0.8
PKAP	0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.5

Variance Decomposition For Rate of Inflation

METHOD 3 (Fair's Method)

Shocks	Quarters Ahead 1	2	3	4	5	6	7	8
CD	0.0	0.0	-0.3	-0.2	1.3	1.6	1.4	1.5
CND	0.0	0.2	0.4	0.0	0.4	0.6	0.8	1.0
CSD	0.0	0.2	0.3	0.3	0.6	0.2	0.3	0.3
CS	0.0	0.3	1.1	1.3	1.6	1.1	1.4	1.2
BGFIR	0.0	0.5	2.3	2.5	2.7	1.6	1.1	0.7
BGFINR	0.0	-1.2	0.2	2.7	3.8	3.1	2.7	0.7
BGFIME	0.0	-0.5	0.4	0.8	1.7	1.9	1.4	-0.1
INVNF	0.0	3.0	3.0	2.6	-1.0	-0.5	-0.1	-0.3
IM	0.0	-0.4	-0.4	1.5	1.9	2.2	3.6	3.6
NTR	0.0	-0.0	0.0	-0.0	-0.1	-0.1	-0.2	-0.2
NPTX	0.0	0.2	0.3	0.5	0.5	0.6	0.5	0.1
NCTX	0.0	0.0	0.0	0.2	0.4	0.5	0.7	0.6
NS	0.0	-0.0	0.0	0.1	0.1	0.1	0.1	0.2
UNR	0.0	0.0	-0.0	-0.1	-0.4	-0.6	-0.4	-0.3
W	0.0	2.2	2.3	1.3	0.4	-0.7	-0.0	0.5
NLI	0.0	0.1	0.2	0.3	0.4	0.3	0.2	0.0
NNLI	0.0	-0.1	-0.3	-0.4	-0.5	-0.2	0.1	0.5
NCPROF	0.0	0.0	0.1	0.3	0.7	0.8	1.1	1.2
ER	0.0	0.1	0.7	2.0	1.2	7.4	10.6	14.2
NINT	0.0	0.0	0.8	3.7	7.6	11.5	12.9	15.7
HM	0.0	0.4	-0.1	0.0	0.3	2.1	2.7	4.7
P	97.1	93.6	86.5	76.3	68.3	61.2	51.6	43.1
NINTUS	2.9	2.9	6.0	7.6	6.9	6.0	7.2	9.5
G	0.0	0.4	-0.1	0.2	0.7	0.3	0.1	-0.6
X	0.0	-2.1	-4.0	-3.6	0.7	-1.1	-0.4	2.3
PIM	0.0	0.0	0.2	0.2	-0.1	-0.6	-0.5	-1.0
PINV	0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.0	-0.0
PGFI	0.0	0.0	0.0	0.3	0.4	0.7	0.7	0.5
INVF	0.0	-0.1	-0.2	-0.2	-0.1	0.3	0.2	0.1
PKAP	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.6

Variance Decomposition For Rate of Inflation

METHOD 3 (Bootstrapping)

Shocks	Quarters Ahead 1	2	3	4	5	6	7	8
CD	0.0	-0.0	-0.2	0.5	1.0	0.5	0.1	0.3
CND	0.0	-0.2	0.4	0.5	-0.4	-0.2	0.2	0.0
CSD	0.0	0.2	0.5	0.5	0.3	-0.1	-0.2	-0.3
CS	0.0	0.1	0.6	1.5	1.8	1.5	1.3	1.3
BGFIR	0.0	0.4	1.4	2.6	2.5	2.6	2.1	2.2
BGFINR	0.0	0.7	0.4	-0.5	-0.7	0.4	1.3	2.9
BGFIME	0.0	1.1	2.1	1.6	2.9	3.8	3.7	5.2
INVNF	0.0	-1.3	-3.2	-1.3	-1.8	-3.2	-3.1	-4.5
IM	0.0	1.1	0.7	1.3	2.7	3.9	3.3	2.9
NTR	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.3
NPTX	0.0	0.0	0.1	-0.0	0.1	0.2	0.4	0.4
NCTX	0.0	0.0	-0.0	0.1	0.1	0.3	0.3	0.2
NS	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3
UNR	0.0	0.0	0.0	-0.4	-0.7	-0.9	-1.1	-1.2
W	0.0	-2.7	-1.4	-1.3	-3.6	-4.1	-4.9	-4.6
NLI	0.0	0.1	0.0	-0.0	-0.2	-0.2	-0.2	-0.3
NNLI	0.0	-0.0	0.0	0.1	0.2	0.2	0.4	0.2
NCPROF	0.0	0.0	0.2	0.5	1.2	1.6	2.1	2.7
ER	0.0	-0.2	0.2	0.8	3.3	5.9	6.3	12.5
NINT	0.0	-0.6	1.3	2.9	6.8	10.4	13.2	14.2
HM	0.0	0.7	-0.3	-1.4	-0.9	0.8	1.4	1.3
P	95.1	93.7	85.5	78.1	67.9	57.0	49.1	36.9
NINTUS	4.9	7.1	10.6	13.5	16.4	16.7	18.9	19.8
G	0.0	0.2	-0.4	-0.7	-0.8	-0.4	-0.7	-1.1
X	0.0	-0.2	2.0	1.4	1.4	3.0	5.9	8.3
PIM	0.0	0.2	0.4	0.5	0.4	-0.2	0.2	-0.1
PINV	0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.0	-0.1
PGFI	0.0	-0.1	0.0	0.2	0.5	0.7	0.6	0.6
INVF	0.0	-0.1	-0.5	-0.3	-0.3	-0.3	-0.2	-0.0
PKAP	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

Notes:
1. Decomposition is based on 100 trials.

TABLE 5A.7

Variance Decomposition For Rate of Inflation

Fair's Method (Method 1)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private sector components of real GDP*								
A.1. Consumption								
CD	0.0	-0.0	0.1	-0.0	0.2	0.2	0.6	0.4
CND	0.0	-0.4	-0.5	-0.2	0.0	0.2	-0.2	0.2
CSD	0.0	0.1	0.2	0.3	0.4	0.3	0.5	0.4
CS	0.0	0.5	0.9	1.0	1.7	1.6	1.8	1.6
Total-a	0.0	0.0	0.4	0.4	1.3	1.0	1.2	1.1
Total-b	0.0	0.1	0.7	1.1	2.3	2.3	2.6	2.5
A.2. Investment								
BGFIR	0.0	0.9	2.3	2.4	2.9	3.2	3.1	2.9
BGFINR	0.0	-0.5	-0.4	-0.2	0.7	0.8	0.7	-0.5
BGFIME	0.0	-0.4	-0.7	-0.6	0.2	0.2	0.0	-0.1
Total-a	0.0	0.4	1.0	1.6	3.1	4.1	5.6	6.2
Total-b	0.0	-0.0	1.2	1.5	3.8	4.2	3.9	2.3
A.3. Inventories								
INVNF	0.0	-1.7	-4.5	-3.9	-6.4	-6.9	-5.1	-7.1
Total-a	0.0	-1.8	-4.7	-4.2	-6.6	-7.3	-5.5	-7.6
A.4. Imports & Exports								
IM	0.0	-6.0	-11.0	-9.6	-11.3	-11.0	-10.8	-7.9

........Continued Table 5A.7

X	0.0	-4.2	-7.4	-9.9	-8.7	-8.3	-7.8	-5.0
Total-a	0.0	-6.9	-10.2	-9.6	-7.4	-5.5	-4.4	1.0
Total-b	0.0	-10.2	-18.4	-19.6	-20.0	-19.2	-18.6	-12.9
Total Contribution of Private Expenditure Components of Real GDP								
Total-a	0.0	-1.1	1.1	1.6	3.8	4.6	6.2	7.0
Total-b	0.0	-12.0	-21.2	-21.1	-20.4	-20.0	-17.6	-15.6
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-0.7	-1.9	-1.6	-1.8	-2.1	-2.1	-1.9
B.2. Other components of Public Sector								
OG	0.0	-0.1	0.1	0.1	-0.1	-0.2	-0.3	-0.2
Total Contribution of Public Sector								
Total-a	0.0	-0.9	-1.9	-1.6	-2.0	-2.3	-2.5	-2.2
Total-b	0.0	-0.9	-1.8	-1.5	-1.9	-2.3	-2.4	-2.1
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.6	-2.0	-2.1	-1.6	-0.1	3.3	7.2
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	4.2	4.0	5.6	9.6	17.1	21.1	26.9	29.3
C.3. High Powered Money								
HM	0.0	1.0	-0.4	-1.8	-3.2	-3.1	-2.3	-0.0
Total Contribution of Financial Sector								
Total-a	4.2	4.4	3.5	6.0	12.9	19.6	30.2	38.5
Total-b	4.2	4.4	3.3	5.7	12.3	17.9	27.9	36.4

........Continued Table 5A.7

D. Prices & Income

D.1. GDP Deflator

P	97.2	93.0	85.7	75.5	60.6	48.3	38.7	32.0

D.2. Nominal Wages

W	0.0	1.1	-0.9	-1.2	-1.9	-1.5	-1.9	-1.1

D.3. Price of Imports

PIM	0.0	0.2	0.4	0.5	0.1	-0.4	-0.9	-2.2

D.4. Labour & Non-Labour Income

PI	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.5

D.5. Corporate profits

NCPROF	0.0	0.0	0.0	0.2	0.7	1.2	2.3	3.0

Total Contribution of Prices & Income

Total-a	97.2	93.4	85.1	74.4	59.6	46.9	37.4	30.9
Total-b	97.2	94.4	85.5	75.2	59.8	47.9	38.5	32.2

E. Unemplotment & Labour Force

E.1. Unemployment Rate

UNR	0.0	0.1	-0.1	-0.3	-0.7	-1.0	-1.3	-1.4

Total Contribution of Unemployment & Labour Force

Total-a	0.0	0.1	-0.1	-0.3	-0.6	-0.8	-1.0	-1.1

Grand Total of all individual Totals

Total-c	101.5	95.8	87.7	80.1	73.7	67.9	70.3	73.1

TABLE 5A.8

Variance Decomposition For Rate of Inflation

Fair's Method (Method 2)

	Quarters Ahead							
	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	0.0	0.0	0.2	0.4	0.6	0.7	0.8
CND	0.0	0.0	0.0	0.2	0.4	0.6	0.7	0.8
CSD	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
CS	0.0	0.1	0.3	0.4	0.4	0.5	0.5	0.4
Total-a	0.0	0.4	1.3	2.0	2.6	3.1	3.3	3.4
Total-b	0.0	0.2	0.5	0.9	1.4	1.7	2.0	2.1
A.2. Investment								
BGFIR	0.0	0.2	0.5	0.6	0.6	0.6	0.5	0.4
BGFINR	0.0	0.3	0.9	1.2	1.5	1.7	1.7	1.7
BGFIME	0.0	0.4	1.2	1.7	2.2	2.5	2.6	2.6
Total-a	0.0	1.3	3.6	4.8	5.9	5.9	5.7	5.2
Total-b	0.0	0.9	2.6	3.5	4.4	4.8	4.8	4.6
A.3. Inventories								
INVNF	0.0	3.9	6.4	5.4	4.7	4.1	3.4	3.0
Total-a	0.0	3.9	6.6	5.6	5.0	4.4	3.6	3.2
A.4. Imports & Exports								
IM	0.0	3.9	9.6	11.2	13.4	15.2	15.7	15.4
X	0.0	3.9	8.7	10.3	13.0	14.5	14.9	14.9

.......Continued Table 5A.8

Total-a	0.0	4.4	10.0	11.5	13.9	16.0	16.4	16.5
Total-b	0.0	7.7	18.3	21.5	26.4	29.7	30.6	30.3

Total Contribution of Private Expenditure Components of Real GDP

Total-a	0.0	2.1	5.9	9.0	13.1	16.0	17.2	17.9
Total-b	0.0	12.8	28.0	31.5	37.2	40.5	41.0	40.2

B. Public Sector

B.1. Government Expenditure on Goods & Services

G	0.0	0.2	0.5	0.5	0.5	0.5	0.5	0.5

B.2. Other components of Public Sector

OG	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2

Total Contribution of Public Sector

Total-a	0.0	0.3	0.6	0.7	0.7	0.7	0.8	0.8
Total-b	0.0	0.2	0.5	0.6	0.6	0.6	0.7	0.7

C. Financial Sector

C.1. Exchange Rate

ER	0.0	0.0	1.0	3.9	9.0	14.7	19.0	21.6

C.2. Domestic & U.S. Rate of Interests (combine contribution)

NT	2.8	4.5	7.9	12.5	17.7	22.3	26.6	29.1

C.3. High Powered Money

HM	0.0	0.1	0.3	0.8	1.8	3.0	4.3	5.3

Total Contribution of Financial Sector

Total-a	2.8	4.5	8.9	16.9	27.9	38.3	47.5	53.9
Total-b	2.8	4.6	9.2	17.2	28.6	40.0	49.8	55.9

D. Prices & Income

.......Continued Table 5A.8

D.1. GDP Deflator								
P	95.8	93.7	92.9	88.4	79.5	71.2	58.3	48.3
D.2. Nominal Wages								
W	0.0	2.5	3.6	4.0	4.4	4.1	3.5	3.0
D.3. Price of Imports								
PIM	0.0	0.0	0.0	0.1	0.2	0.4	0.7	1.0
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
D.5. Corporate profits								
NCPROF	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.5
Total Contribution of Prices & Income								
Total-a	95.8	97.2	96.9	93.4	84.6	77.1	64.1	54.2
Total-b	95.8	96.1	96.5	92.6	84.4	76.0	63.0	53.0
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Total Contribution of Unemployment & Labour Force								
Total-a	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Grand Total of all individual Totals								
Total-c	98.5	104.2	112.3	120.0	126.3	132.1	129.8	126.9

TABLE 5A.9

Variance Decomposition For Rate of Unemployment

Fair's Method (Method 1)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.4	0.9	2.3	3.7	5.4	7.2	8.7
CND	0.0	1.2	1.7	2.1	2.8	3.5	4.2	4.4
CSD	0.0	0.6	1.0	1.5	2.0	2.6	2.9	3.2
CS	0.0	0.7	1.7	3.1	3.5	4.0	3.9	4.3
Total-a	0.0	2.0	4.9	8.3	10.9	14.1	16.5	18.4
Total-b	0.0	2.1	5.3	9.0	12.0	15.6	18.3	20.5
A.2. Investment								
BGFIR	0.0	1.0	2.0	3.4	4.1	4.3	4.0	4.2
BGFINR	0.0	1.2	2.2	2.6	3.4	4.1	5.0	5.4
BGFIME	0.0	3.2	5.3	8.2	9.6	11.7	12.0	12.2
Total-a	0.0	6.2	9.3	10.2	12.9	14.7	16.3	16.2
Total-b	0.0	5.3	9.5	14.1	17.2	20.1	21.0	21.9
A.3. Inventories								
INVNF	0.0	-5.1	-8.2	-9.0	-12.2	-13.4	-14.3	-15.1
Total-a	0.0	-5.5	-9.2	-10.2	-13.5	-15.2	-16.1	-16.9
A.4. Imports & Exports								
IM	0.0	-18.1	-26.4	-31.9	-36.6	-38.6	-37.2	-37.7

......Continued Table 5A.9

X	0.0	9.0	10.4	13.0	18.0	21.1	21.9	23.1
Total-a	0.0	-5.1	-8.1	-8.1	-5.0	-1.3	3.1	5.1
Total-b	0.0	-9.1	-16.0	-18.9	-18.6	-17.5	-15.3	-14.6

Total Contribution of Private Expenditure Components of Real GDP

Total-a	0.0	5.9	10.1	18.4	24.3	32.7	38.6	42.2
Total-b	0.0	-7.3	-10.4	-6.0	-2.9	3.0	7.9	10.9

B. Public Sector

B.1. Government Expenditure on Goods & Services

G	0.0	-1.9	-2.9	-3.4	-3.1	-3.1	-2.6	-2.4

B.2. Other components of Public Sector

OG	0.0	-0.4	-0.3	-0.3	-0.3	-0.3	-0.1	-0.2

Total Contribution of Public Sector

Total-a	0.0	-2.3	-3.2	-3.7	-3.4	-3.5	-2.9	-2.7
Total-b	0.0	-2.3	-3.2	-3.6	-3.3	-3.4	-2.8	-2.6

C. Financial Sector

C.1. Exchange Rate

ER	0.0	-0.1	-0.2	-0.3	-0.5	-0.7	-0.7	-0.8

C.2. Domestic & U.S. Rate of Interests (combine contribution)

NT	0.0	-0.4	-0.8	-1.0	-1.7	-2.1	-2.3	-2.8

C.3. High Powered Money

HM	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.2	-0.2

Total Contribution of Financial Sector

Total-a	0.0	-0.4	-1.1	-1.3	-2.2	-2.8	-3.1	-3.8

......Continued Table 5A.9

Total-b	0.0	-0.4	-1.1	-1.3	-2.2	-2.8	-3.2	-3.8
D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
D.2. Nominal Wages								
W	0.0	0.1	0.3	0.4	0.6	0.7	1.0	1.3
D.3. Price of Imports								
PIM	0.0	0.1	0.0	-0.2	-0.3	-0.8	-0.9	-1.0
D.4. Labour & Non-Labour Income								
PI	0.0	-0.2	-0.5	-0.8	-1.1	-1.4	-1.7	-2.1
D.5. Corporate profits								
NCPROF	0.0	0.0	0.3	1.2	2.0	3.2	4.6	6.1
Total Contribution of Prices & Income								
Total-a	0.0	-0.0	0.2	0.6	1.2	1.9	3.2	4.6
Total-b	0.0	-0.0	0.2	0.5	1.2	1.7	3.0	4.4
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	97.5	94.2	89.8	84.9	79.9	75.5	71.7
Total Contribution of Unemployment & Labour Force								
Total-a	100.0	97.5	94.2	89.9	85.0	80.0	75.7	71.9
Grand Total of all individual Totals								
Total-c	100.0	100.6	100.3	103.8	104.9	108.3	111.5	112.2

TABLE 5A.10

Variance Decomposition For Rate of Unemployment

Fair's Method (Method 2)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	0.0	0.1	0.2	0.4	0.6	0.8	1.0
CND	0.0	0.0	0.1	0.2	0.4	0.6	0.8	1.0
CSD	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
CS	0.0	0.2	0.3	0.4	0.5	0.6	0.6	0.7
Total-a	0.0	0.5	1.2	2.1	2.9	3.6	4.2	4.7
Total-b	0.0	0.2	0.5	0.9	1.4	1.9	2.4	2.8
A.2. Investment								
BGFIR	0.0	0.2	0.5	0.6	0.7	0.7	0.6	0.6
BGFINR	0.0	0.4	0.9	1.3	1.7	2.0	2.2	2.3
BGFIME	0.0	0.5	1.1	1.9	2.5	3.0	3.4	3.6
Total-a	0.0	1.3	2.9	4.6	6.3	7.0	7.2	8.2
Total-b	0.0	1.1	2.5	3.8	4.8	5.6	6.2	6.5
A.3. Inventories								
INVNF	0.0	4.7	5.9	5.7	5.2	4.8	4.2	4.0
Total-a	0.0	4.8	6.0	6.0	5.6	5.1	4.5	4.2
A.4. Imports & Exports								
IM	0.0	4.7	9.0	12.3	15.2	18.5	20.8	22.4

......Continued Table 5A.10

X	0.0	4.7	8.1	11.2	14.7	17.4	19.8	21.2
Total-a	0.0	5.4	9.3	12.6	15.9	19.2	21.6	23.7
Total-b	0.0	9.5	17.1	23.5	29.9	35.8	40.5	43.7
Total Contribution of Private Expenditure Components of Real GDP								
Total-a	0.0	2.6	5.6	9.5	14.1	18.3	21.8	24.6
Total-b	0.0	15.6	26.1	34.2	41.7	48.5	53.6	57.1
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	0.3	0.4	0.5	0.5	0.6	0.6	0.7
B.2. Other components of Public Sector								
OG	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3
Total Contribution of Public Sector								
Total-a	0.0	0.3	0.6	0.7	0.8	0.9	1.0	1.1
Total-b	0.0	0.3	0.5	0.6	0.7	0.8	0.9	1.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.5
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.0	0.0	0.1	0.2	0.3	0.5	0.8	1.1
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Contribution of Financial Sector								
Total-a	0.0	0.0	0.1	0.2	0.5	0.8	1.2	1.6
Total-b	0.0	0.0	0.1	0.3	0.5	0.8	1.2	1.6

......Continued Table 5A.10

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D.2. Nominal Wages								
W	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
D.3. Price of Imports								
PIM	0.0	0.0	0.0	0.1	0.2	0.5	0.8	1.2
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2
D.5. Corporate profits								
NCPROF	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.7
Total Contribution of Prices & Income								
Total-a	0.0	0.0	0.1	0.2	0.4	0.8	1.3	2.0
Total-b	0.0	0.0	0.1	0.2	0.5	0.9	1.5	2.2
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	96.4	93.3	85.3	79.1	70.8	63.0	58.3
Total Contribution of Unemployment & Labour Force								
Total-a	100.0	96.4	93.4	85.4	79.3	71.0	63.2	58.6
Grand Total of all individual Totals								
Total-c	100.0	99.4	99.7	96.1	95.1	91.7	88.5	87.8

TABLE 5A.11

Variance Decomposition For Rate of Inflation

METHOD 1 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.1	0.0	0.2	0.8	0.7	0.5	0.3
CND	0.0	-0.4	-0.4	-0.2	-0.4	-0.5	-0.3	-0.3
CSD	0.0	0.1	0.2	0.1	0.4	0.2	0.2	0.2
CS	0.0	0.5	1.1	1.7	2.2	2.2	2.0	2.1
Total1-a	0.0	0.0	0.4	1.0	1.9	1.3	1.1	1.0
Total1-b	0.0	0.1	0.9	1.8	3.0	2.6	2.4	2.3
A.2. Investment								
BGFIR	0.0	1.0	2.3	2.9	3.0	2.7	2.7	2.6
BGFINR	0.0	-0.1	-0.4	-0.3	0.1	0.5	1.3	1.7
BGFIME	0.0	-0.1	0.0	0.2	1.6	2.4	3.0	3.2
Total2-a	0.0	0.4	1.0	1.6	3.1	4.1	5.6	6.2
Total2-b	0.0	0.8	1.9	2.8	4.7	5.6	7.0	7.5
A.3. Inventories								
INVNF	0.0	-2.1	-5.4	-7.0	-7.2	-6.4	-6.2	-5.9
Total3-a	0.0	-2.2	-5.7	-7.4	-7.6	-6.8	-6.4	-6.1
A.4. Imports & Exports								
IM	0.0	-2.7	-5.6	-5.6	-7.0	-4.8	-5.1	-4.0

......Continued Table 5A.11

X	0.0	-6.9	-11.9	-10.1	-7.0	-8.2	-6.5	-5.9
Total4-a	0.0	-6.5	-10.2	-7.2	-3.2	-1.3	0.2	2.5
Total4-b	0.0	-9.6	-17.5	-15.7	-14.0	-13.0	-11.6	-9.9
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	0.0	-1.4	0.3	2.2	8.3	10.6	11.9	13.4
Total5-b	0.0	-10.9	-20.4	-18.5	-13.9	-11.6	-8.6	-6.2
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	-1.1	-1.5	-1.2	-2.0	-1.9	-1.6	-1.8
B.2. Other components of Public Sector								
OG	0.0	-0.1	-0.3	-0.1	-0.2	0.2	0.5	0.7
Total Contribution of Public Sector								
Total6-a	0.0	-1.2	-1.9	-1.4	-2.3	-1.8	-1.2	-1.1
Total6-b	0.0	-1.2	-1.8	-1.3	-2.2	-1.7	-1.1	-1.1
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	-0.8	-2.1	-3.6	-0.9	4.9	6.3	10.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	2.6	4.1	8.1	15.0	19.0	21.3	26.6	27.0
C.3. High Powered Money								
HM	0.0	1.4	-0.8	-3.3	-3.8	-2.6	-0.7	0.7
Total Contribution of Financial Sector								
Total7-a	2.6	4.8	5.4	8.4	14.5	23.5	31.6	37.1
Total7-b	2.6	4.7	5.2	8.1	14.3	23.6	32.2	38.1

......Continued Table 5A.11

D. Prices & Income

D.1. GDP Deflator								
P	97.5	92.9	85.2	72.9	58.0	45.9	36.3	28.3
D.2. Nominal Wages								
W	0.0	-0.9	-1.8	-2.9	-3.7	-3.3	-4.2	-4.0
D.3. Price of Imports								
PIM	0.0	0.4	0.8	1.0	0.5	-0.7	-1.3	-2.3
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.1	0.2	0.6	0.7	0.9
D.5. Corporate profits								
NCPROF	0.0	0.0	0.2	0.8	1.8	2.1	2.8	3.0
Total Contribution of Prices & Income								
Total8-a	97.5	93.1	84.5	72.4	57.1	44.0	33.8	25.1
Total8-b	97.5	92.4	84.4	71.9	56.8	44.6	34.3	25.9
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.0	-0.1	-0.5	-1.0	-1.0	-1.2	-1.2
Total Contribution of Unemployment & Labour Force								
Total9-a	0.0	0.0	-0.1	-0.4	-0.8	-0.8	-0.9	-0.9
Grand Total of all individual Totals								
Total-c	100.1	95.3	88.2	81.2	76.8	75.5	75.2	73.6

TABLE 5A.12

Variance Decomposition For Rate of Inflation

METHOD 2 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	0.0	0.0	0.2	0.4	0.6	0.7	0.7
CND	0.0	0.2	0.5	0.6	0.7	0.7	0.6	0.6
CSD	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
CS	0.0	0.1	0.3	0.4	0.4	0.4	0.4	0.4
Total-a	0.0	0.5	1.5	2.2	2.8	3.0	3.1	3.1
Total-b	0.0	0.3	0.9	1.3	1.6	1.8	1.8	1.8
A.2. Investment								
BGFIR	0.0	0.2	0.5	0.6	0.6	0.5	0.4	0.4
BGFINR	0.0	0.3	0.9	1.2	1.4	1.5	1.5	1.4
BGFIME	0.0	0.4	1.2	1.7	2.3	2.4	2.5	2.5
Total-a	0.0	1.3	3.6	4.8	5.9	5.9	5.8	5.6
Total-b	0.0	0.9	2.6	3.5	4.3	4.4	4.4	4.3
A.3. Inventories								
INVNF	0.0	3.4	6.1	5.4	5.0	4.2	3.3	2.7
Total-a	0.0	3.5	6.2	5.5	5.2	4.5	3.5	2.9
A.4. Imports & Exports								
IM	0.0	3.6	8.8	10.2	11.9	13.0	13.1	13.2

.......Continued Table 5A.12

X	0.0	4.1	9.0	10.3	12.9	13.8	13.7	14.0
Total-a	0.0	4.2	10.0	11.5	13.8	15.0	14.9	14.7
Total-b	0.0	7.7	17.8	20.5	24.8	26.8	26.8	27.2
Total Contribution of Private Expenditure Components of Real GDP								
Total-a	0.0	2.2	6.3	9.7	13.6	15.2	15.9	16.7
Total-b	0.0	12.4	27.5	30.8	35.9	37.5	36.5	36.2
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	0.2	0.5	0.5	0.5	0.5	0.4	0.4
B.2. Other components of Public Sector								
OG	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2
Total Contribution of Public Sector								
Total-a	0.0	0.3	0.6	0.7	0.7	0.7	0.7	0.7
Total-b	0.0	0.2	0.6	0.6	0.7	0.7	0.6	0.6
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	0.0	1.0	4.0	9.4	15.1	19.8	23.2
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	2.5	4.4	7.8	12.6	17.3	21.7	25.2	28.0
C.3. High Powered Money								
HM	0.0	0.1	0.3	0.8	1.9	3.0	4.1	5.0
Total Contribution of Financial Sector								
Total-a	2.5	4.4	8.8	17.2	28.4	39.9	49.7	57.2
Total-b	2.5	4.5	9.1	17.4	28.6	39.8	49.1	56.2

.......Continued Table 5A.12

D. Prices & Income

D.1. GDP Deflator

P	97.4	96.0	92.4	87.6	76.3	63.3	53.2	46.6
D.2. Nominal Wages								
W	0.0	2.4	3.6	3.9	4.2	3.8	3.4	2.9
D.3. Price of Imports								
PIM	0.0	0.0	0.0	0.1	0.2	0.4	0.6	0.9
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
D.5. Corporate profits								
NCPROF	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5
Total Contribution of Prices & Income								
Total-a	97.4	97.7	96.0	91.1	80.5	68.6	58.2	51.7
Total-b	97.4	98.4	96.0	91.6	80.9	67.8	57.7	51.1
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Total Contribution of Unemployment & Labour Force								
Total-a	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Grand Total of all individual Totals								
Total-c	99.9	104.6	111.7	118.7	123.3	124.5	124.6	126.4

TABLE 5A.13

Variance Decomposition For Rate of Unemployment

METHOD 1 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	-0.4	1.1	2.5	4.3	5.5	6.5	7.4
CND	0.0	1.5	2.2	2.8	3.0	3.1	2.9	3.5
CSD	0.0	0.9	1.3	1.8	2.2	2.3	2.4	2.7
CS	0.0	1.2	2.4	3.0	3.4	3.9	4.4	4.9
Total-a	0.0	3.1	6.4	9.1	11.5	13.3	14.3	16.4
Total-b	0.0	3.2	7.0	10.1	12.9	14.8	16.2	18.5
A.2. Investment								
BGFIR	0.0	1.8	3.5	4.0	4.1	3.8	3.4	3.3
BGFINR	0.0	1.3	2.1	1.8	2.9	3.3	3.6	4.0
BGFIME	0.0	3.5	5.0	6.2	8.2	9.8	11.1	11.7
Total-a	0.0	6.1	9.6	10.8	13.4	15.0	16.1	16.9
Total-b	0.0	6.6	10.6	12.0	15.2	16.9	18.1	19.0
A.3. Inventories								
INVNF	0.0	-6.1	-8.8	-10.7	-11.6	-11.3	-10.7	-12.4
Total-a	0.0	-6.2	-8.9	-11.0	-12.4	-12.4	-11.9	-13.8
A.4. Imports & Exports								
IM	0.0	-14.8	-23.2	-25.4	-32.2	-33.6	-36.4	-37.5

......Continued Table 5A.13

X	0.0	8.2	12.6	15.1	18.7	19.2	21.2	25.4
Total-a	0.0	-2.7	-3.6	-1.2	-0.8	-0.3	1.5	7.1
Total-b	0.0	-6.6	-10.6	-10.3	-13.5	-14.4	-15.2	-12.1

Total Contribution of Private Expenditure Components of Real GDP

Total-a	0.0	8.8	17.2	22.2	28.4	32.1	35.8	41.6
Total-b	0.0	-3.0	-1.9	0.8	2.2	4.9	7.2	11.6

B. Public Sector

B.1. Government Expenditure on Goods & Services

G	0.0	-1.8	-2.4	-2.8	-3.3	-3.1	-3.2	-3.0

B.2. Other components of Public Sector

OG	0.0	-0.3	-0.5	-0.4	-0.5	0.1	0.2	0.3

Total Contribution of Public Sector

Total-a	0.0	-2.1	-2.9	-3.3	-3.9	-3.2	-3.1	-2.8
Total-b	0.0	-2.1	-2.9	-3.2	-3.8	-3.0	-3.0	-2.7

C. Financial Sector

C.1. Exchange Rate

ER	0.0	0.0	-0.1	-0.2	-0.3	-0.1	-0.2	0.1

C.2. Domestic & U.S. Rate of Interests (combine contribution)

NT	0.0	-0.3	-0.7	-1.2	-2.0	-2.3	-2.7	-3.4

C.3. High Powered Money

HM	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.2

Total Contribution of Financial Sector

Total-a	0.0	-0.3	-0.8	-1.5	-2.4	-2.4	-3.0	-3.4
Total-b	0.0	-0.3	-0.8	-1.4	-2.4	-2.5	-3.0	-3.5

......Continued Table 5A.13

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
D.2. Nominal Wages								
W	0.0	0.2	0.4	0.5	0.7	0.9	1.1	1.3
D.3. Price of Imports								
PIM	0.0	0.0	0.1	0.0	0.0	-0.4	-0.6	-1.6
D.4. Labour & Non-Labour Income								
PI	0.0	-0.2	-0.4	-0.5	-0.9	-1.0	-1.2	-1.5
D.5. Corporate profits								
NCPROF	0.0	0.0	0.4	0.9	1.9	2.9	3.8	4.9
Total Contribution of Prices & Income								
Total-a	0.0	0.0	0.4	0.8	1.7	2.4	3.3	3.6
Total-b	0.0	0.0	0.5	0.9	1.7	2.4	3.2	3.4
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	97.6	94.2	90.2	84.5	80.9	76.4	71.9
Total Contribution of Unemployment & Labour Force								
Total-a	100.0	97.6	94.3	90.3	84.6	81.1	76.6	72.1
Grand Total of all individual Totals								
Total-c	100.0	104.0	108.2	108.5	108.4	110.0	109.6	111.1

TABLE 5A.14

Variance Decomposition For Rate of Unemployment

METHOD 2 (Bootstrapping)

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	0.0	0.0	0.1	0.2	0.4	0.6	0.8	1.0
CND	0.0	0.3	0.5	0.6	0.7	0.8	0.9	0.9
CSD	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
CS	0.0	0.2	0.3	0.4	0.5	0.5	0.6	0.6
Total-a	0.0	0.6	1.4	2.2	3.1	3.5	4.1	4.6
Total-b	0.0	0.5	1.0	1.3	1.7	2.1	2.5	2.7
A.2. Investment								
BGFIR	0.0	0.2	0.5	0.6	0.7	0.6	0.6	0.5
BGFINR	0.0	0.4	0.8	1.2	1.6	1.8	2.0	2.1
BGFIME	0.0	0.5	1.1	1.7	2.5	2.8	3.2	3.6
Total-a	0.0	1.5	3.3	4.8	6.5	7.0	7.7	8.3
Total-b	0.0	1.1	2.4	3.5	4.8	5.2	5.8	6.2
A.3. Inventories								
INVNF	0.0	4.0	5.5	5.2	5.5	4.8	4.3	3.8
Total-a	0.0	4.1	5.6	5.3	5.8	5.0	4.5	4.0
A.4. Imports & Exports								
IM	0.0	4.3	8.1	10.2	13.6	15.4	17.5	19.8

......Continued Table 5A.14

X	0.0	4.8	8.2	10.6	15.0	16.7	19.1	21.6
Total-a	0.0	4.9	9.2	11.8	16.1	18.2	20.6	23.0
Total-b	0.0	9.1	16.3	20.8	28.6	32.1	36.6	41.4
Total Contribution of Private Expenditure Components of Real GDP								
Total-a	0.0	2.6	5.9	9.7	14.9	17.7	21.1	24.5
Total-b	0.0	14.8	25.3	30.9	40.9	44.4	49.4	54.3
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	0.0	0.3	0.4	0.5	0.6	0.6	0.6	0.7
B.2. Other components of Public Sector								
OG	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3
Total Contribution of Public Sector								
Total-a	0.0	0.3	0.6	0.7	0.8	0.9	1.0	1.1
Total-b	0.0	0.3	0.5	0.6	0.8	0.8	0.9	1.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.6
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.0	0.0	0.1	0.2	0.3	0.5	0.8	1.1
C.3. High Powered Money								
HM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Contribution of Financial Sector								
Total-a	0.0	0.0	0.1	0.2	0.5	0.8	1.2	1.6
Total-b	0.0	0.0	0.1	0.3	0.5	0.8	1.2	1.7

......Continued Table 5A.14

D. Prices & Income								
D.1. GDP Deflator								
P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D.2. Nominal Wages								
W	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
D.3. Price of Imports								
PIM	0.0	0.0	0.0	0.1	0.2	0.4	0.7	1.2
D.4. Labour & Non-Labour Income								
PI	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2
D.5. Corporate profits								
NCPROF	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.6
Total Contribution of Prices & Income								
Total-a	0.0	0.0	0.1	0.2	0.5	0.8	1.3	2.0
Total-b	0.0	0.0	0.0	0.1	0.4	0.8	1.4	2.1
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	100.0	93.0	85.2	80.6	74.7	69.7	65.5	59.3
Total Contribution of Unemployment & Labour Force								
Total-a	100.0	93.0	85.3	80.7	74.9	69.9	65.7	59.5
Grand Total of all individual Totals								
Total-c	100.0	95.9	92.0	91.5	91.6	90.1	90.3	88.7

TABLE 5A.15

Variance Decomposition For Real GDP

METHOD 3 (Bootstrapping)*

Quarters Ahead

	1	2	3	4	5	6	7	8
Shocks								
A. *Private Expenditure Components of Real GDP*								
A.1. Consumption								
CD	-1.9	6.3	8.5	9.2	9.7	9.0	9.6	10.0
CND	8.2	5.7	6.6	4.7	4.6	4.3	2.6	3.6
CSD	5.4	3.6	3.7	3.2	2.9	2.9	2.0	2.4
CS	9.6	7.6	6.1	5.2	4.1	4.8	4.2	4.0
Total1-a	21.6	23.3	24.9	22.4	21.4	20.9	18.5	19.8
Total1-b	21.3	23.1	24.9	22.2	21.3	20.9	18.4	19.9
A.2. Investment								
BGFIR	4.0	6.7	6.2	4.8	3.2	3.3	2.1	2.9
BGFINR	4.1	7.2	6.8	6.5	6.3	6.5	5.8	5.6
BGFIME	8.4	10.2	11.6	12.5	12.1	14.1	11.0	11.2
Total2-a	17.0	24.3	24.6	24.0	21.7	23.9	18.9	19.7
Total2-b	16.5	24.0	24.5	23.8	21.6	23.8	18.9	19.6
A.3. Inventories								
INVNF	-5.9	-5.3	-2.8	-2.1	-3.4	1.2	4.9	0.1
Total3-a	-6.8	-5.3	-2.8	-2.8	-3.6	1.3	4.7	-0.1
A.4. Imports & Exports								
IM	7.1	13.9	12.7	10.9	15.3	8.2	11.0	10.9
X	63.2	38.3	36.1	38.3	34.2	33.4	32.9	33.3

......Continued Table 5A.15

Total4-a	67.7	51.8	47.9	48.8	49.1	41.1	43.3	44.3
Total4-b	70.3	52.2	48.7	49.2	49.5	41.5	43.9	44.2
Total Contribution of Private Expenditure Components of Real GDP								
Total5-a	97.3	93.7	93.6	91.9	88.3	86.6	85.2	83.3
Total5-b	101.3	94.0	95.2	92.5	88.8	87.5	85.7	83.5
B. Public Sector								
B.1. Government Expenditure on Goods & Services								
G	1.0	2.4	0.8	0.6	1.9	1.1	1.1	1.0
B.2. Other components of Public Sector								
OG	-0.7	-0.2	0.2	0.5	0.9	0.7	0.5	0.0
Total Contribution of Public Sector								
Total6-a	0.3	2.1	1.0	1.1	2.8	1.9	1.5	0.9
Total6-b	0.3	2.2	1.0	1.1	2.8	1.8	1.5	1.0
C. Financial Sector								
C.1. Exchange Rate								
ER	0.3	0.0	0.1	0.6	-0.0	0.2	0.9	0.4
C.2. Domestic & U.S. Rate of Interests (combine contribution)								
NT	0.6	1.5	1.4	1.8	2.2	2.0	2.7	2.1
C.3. High Powered Money								
HM	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2
Total Contribution of Financial Sector								
Total7-a	0.9	1.5	1.4	2.2	2.0	2.0	3.4	2.3
Total7-b	0.9	1.4	1.4	2.2	1.9	2.0	3.4	2.3

......Continued Table 5A.15

D. Prices & Income								
D.1. GDP Deflator								
P	-0.1	-0.1	-0.1	-0.2	0.1	0.4	0.6	0.8
D.2. Nominal Wages								
W	0.5	0.8	0.7	0.6	0.8	0.8	1.1	1.4
D.3. Price of Imports								
PIM	0.2	-0.2	-0.1	-0.5	0.0	1.0	0.3	1.7
D.4. Labour & Non-Labour Income								
PI	0.2	-0.2	-0.3	-0.4	-0.3	-0.4	-0.3	-0.6
D.5. Corporate profits								
NCPROF	-2.5	1.4	2.7	4.0	5.0	6.2	6.6	8.0
Total Contribution of Prices & Income								
Total8-a	0.9	1.7	2.8	3.5	5.6	8.0	8.3	11.4
Total8-b	-1.7	1.8	2.8	3.6	5.5	8.0	8.3	11.4
E. Unemplotment & Labour Force								
E.1. Unemployment Rate								
UNR	0.4	0.8	0.9	1.1	1.2	1.3	1.4	1.7
Total Contribution of Unemployment & Labour Force								
Total9-a	0.8	1.1	1.3	1.5	1.5	1.7	1.8	2.1
Grand Total of all individual Totals								
Total-c	100.0	100.0	100.0	100.1	100.1	100.1	100.0	100.0

* Sample mean was subtracted from all the residual series prior to bootstrapping.

TABLE 5A.16

Precision of The Stochastic Simulation Estimates For Real GDP

METHOD 3 (Fair's Technique)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	-387046.3	2088892 0	4694372.2	6032874.1
	39594.4	245796.9	369455.7	452865.0
	-9.8	8.5	12.7	13.3
CND	534721.6	1512973.7	2562825.6	3450627.4
	199182.3	311164.1	382366.4	465511.0
	2.7	4.9	6.7	7.4
CSD	1073784.1	1527863.1	1888813.5	2532096.2
	99719.4	146568.9	171559.0	227519.1
	10.8	10.4	11.0	11.1
CS	1638522.9	2494404.0	3100414.3	3477882.2
	177524.3	273900.2	324029.4	406310.8
	9.2	9.1	9.6	8.6
Totall	3910671.5	8443947.1	12623472.5	15691634.6
	324466.6	653067.6	799802.4	1014647.1
	12.1	12.9	15.8	15.5
BGFIR	850888.3	2497789.8	3136600.2	3197974.9
	211198.9	336112.0	414854.9	468115.0
	4.0	7.4	7.6	6.8
BGFINR	1440714.5	3563174.3	4013428.2	5624819.9
	320257.8	469448.8	558388.0	715068.8
	4.5	7.6	7.2	7.9
BGFIME	958550.7	4276538.8	7390903.5	8865817.1
	332160.3	486835.1	706996.3	888424.2
	2.9	8.8	10.5	10.0

.....Continued Table 5A.16

Total2	3809666.3	9311556.6	12965899.0	17141740.6
	614462.3	950158.8	1271166.6	1416672.7
	6.2	9.8	10.2	12.1
INVNF	-2712639.2	-2857945.8	-1995453.2	-2763082.1
	1230377.0	1243509.4	1342555.8	1651032.2
	-2.2	-2.3	-1.5	-1.7
Total3	-3011523.2	-3226141.3	-2229993.7	-3137019.3
	1234840.1	1251505.7	1366423.5	1686991.2
	-2.4	-2.6	-1.6	-1.9
IM	3750999.7	7434031.4	4512872.2	6868666.7
	1105842.8	1371177.7	1684337.6	2136970.5
	3.4	5.4	2.7	3.2
X	12382533.4	12471273.3	19257902.9	27928634.5
	1116766.6	1403066.6	1872062.0	2334472.7
	11.1	8.9	10.3	12.0
Total4	16522399.5	20131530.6	23852663.1	35265213.3
	1348381.1	1536254.6	1854873.4	2349163.3
	12.3	13.1	12.9	15.0
Total5	21171072.2	35250832.2	48549550.8	66063051.2
	1053894.4	1657418.5	2210271.7	2875667.7
	20.1	21.3	22.0	23.0
G	781608.4	1443426.5	1413416.9	580969.1
	230998.6	361268.2	379197.3	437670.1
	3.4	4.0	3.7	1.3
OG	-114891.9	420112.9	309732.1	160567.2
	77221.0	132133.7	176779.2	228475.4
	-1.5	3.2	1.8	0.7
Total6	663170.2	1853756.8	1719047.1	741571.7
	258322.0	409403.8	444175.9	505010.3
	2.6	4.5	3.9	1.5
ER	-4030.1	-118919.6	-126679.6	-326687.3
	32221.7	87263.3	157443.4	240296.0
	-0.1	-1.4	-0.8	-1.4

.....Continued Table 5A.16

NT	217246.9	622839.0	1144327.4	1143014.6
	46980.2	138060.9	233658.2	339993.1
	4.6	4.5	4.9	3.4
HM	6.11E-18	-24469.8	-51778.3	-95237.8
	0.0	4696.4	8861.0	15841.8
	--	-5.2	-5.8	-6.0
Total7	213025.0	476962.7	959706.1	718812.3
	57486.9	164839.6	282094.8	402112.9
	3.7	2.9	3.4	1.8
P	-12615.3	-16866.8	-59066.1	-137287.3
	3626.8	18078.0	32526.1	41914.1
	-3.5	-0.9	-1.8	-3.3
W	121595.8	277231.5	326094.3	460951.1
	17447.1	39927.1	58688.5	81429.4
	7.0	6.9	5.6	5.7
PIM	-12094.4	-233610.3	-758433.9	-570208.5
	36597.8	97803.0	183307.7	298362.9
	-0.3	-2.4	-4.1	-1.9
PI	5619.2	-26172.5	-90229.0	-217466.5
	27518.8	62977.7	105020.0	162060.1
	0.2	-0.4	-0.9	-1.3
NCPROF	3875.0	504718.9	1570795.8	3184411.6
	681.4	65926.8	155327.6	286658.7
	5.7	7.7	10.1	11.1
Total8	106376.3	505994.6	989177.4	2719111.2
	44044.2	131907.0	244354.0	414890.4
	2.4	3.8	4.0	6.6
UNR	64151.4	147779.1	325901.9	683592.1
	9035.4	25926.2	48642.1	92377.3
	7.1	5.7	6.7	7.4
Total9	126719.1	238974.8	475906.3	889453.6
	18365.1	43450.0	73216.4	117033.4
	6.9	5.5	6.5	7.6

.....Continued Table 5A.16

$\hat{\sigma}^2$	22278750.3	38319163.1	52706908.2	71127551.0
$[v\hat{a}r(\hat{\sigma}^2)]^{1/2}$	1072782.5	1790639.3	2314041.8	2981759.7
ζ_b	20.8	21.4	22.8	23.9

	Quarters Ahead			
	5	6	7	8
Shocks				
CD	8059001.8	9409994.8	10619925.4	11272384.3
	544160.7	584248.4	705304.3	748444.1
	14.8	16.1	15.1	15.1
CND	4262539.5	4865516.4	5886686.3	5039544.1
	519408.9	543480.1	630017.3	607437.2
	8.2	9.0	9.3	8.3
CSD	2476392.0	2865499.6	2990831.7	3162003.6
	219012.2	247273.0	282938.3	282576.7
	11.3	11.6	10.6	11.2
CS	3628642.8	2999647.9	4246583.2	3803382.2
	457909.5	450825.6	505965.9	484738.9
	7.9	6.7	8.4	7.8
Total1	18344122.2	19942788.6	23300800.2	22950118.0
	1170250.8	1240900.7	1489672.9	1445864.6
	15.7	16.1	15.6	15.9
BGFIR	3163118.1	2824622.7	3173123.1	2324157.4
	488247.0	492263.7	536723.0	579234.6
	6.5	5.7	5.9	4.0

.....Continued Table 5A.16

BGFINR	6110671.1	7190987.3	6746729.8	7684530.8
	767300.6	851564.1	919701.3	886267.4
	8.0	8.4	7.3	8.7
BGFIME	9023631.1	9636618.5	11685202.5	13205886.8
	1018628.5	1136708.1	1234465.1	1325946.2
	8.9	8.5	9.5	10.0
Total2	17636092.0	22150999.0	19578930.0	21782487.0
	1560716.1	1830661.1	1977669.7	1944864.9
	11.3	12.1	9.9	11.2
INVNF	-1983957.1	-1823624.0	-3249962.0	1121665.9
	1770202.6	1907305.6	2019016.8	2085223.8
	-1.1	-1.0	-1.6	0.5
Total3	-2465369.2	-2352438.2	-3724861.3	676014.7
	1790176.4	1930803.7	2045506.9	2114845.3
	-1.4	-1.2	-1.8	0.3
IM	10336368.1	8513022.9	9306111.5	6455019.8
	2391299.3	2590630.3	2887835.2	2795859.2
	4.3	3.3	3.2	2.3
X	27812584.8	33762350.8	35458932.0	39308245.2
	2440777.9	2656312.3	2851485.4	3143423.9
	11.4	12.7	12.4	12.5
Total4	38029026.0	42335703.4	46011724.2	46292317.5
	2613461.6	2857267.5	3197428.0	3151505.0
	14.6	14.8	14.4	14.7
Total5	71840647.0	79923840.8	87777178.0	93195571.8
	3271441.2	3456570.8	3998010.2	4420072.5
	22.0	23.1	22.0	21.1
G	2600212.3	961841.4	1758004.1	706230.5
	492590.6	527574.3	580367.8	580596.4
	5.3	1.8	3.0	1.2
OG	385283.9	547250.0	645363.8	448118.1
	252595.3	296878.5	339759.1	383259.3
	1.5	1.8	1.9	1.2

.....Continued Table 5A.16

Total6	2995451.3	1501901.9	2406443.7	1145133.3
	571585.4	637642.7	732468.1	746666.1
	5.2	2.4	3.3	1.5
ER	-337745.3	-418755.5	-445325.8	-161453.2
	310203.1	393370.9	448997.8	491974.5
	-1.1	-1.1	-1.0	-0.3
NT	1204565.7	1699847.5	2163857.5	2425224.4
	442786.0	546511.7	639365.7	732865.3
	2.7	3.1	3.4	3.3
HM	-147266.6	-202479.9	-230233.7	-255247.1
	21714.7	30472.3	34286.6	35779.0
	-6.8	-6.6	-6.7	-7.1
Total7	728191.3	1060733.3	1480241.8	2011439.0
	519500.3	667733.4	726413.2	853608.9
	1.4	1.6	2.0	2.4
P	7608.0	194561.1	703207.1	1248658.4
	67937.4	112485.0	178375.7	225028.1
	0.1	1.7	3.9	5.5
W	644847.7	894382.6	1206099.9	1904538.3
	115850.1	172980.9	244584.9	292354.1
	5.6	5.2	4.9	6.5
PIM	-288662.6	248535.6	301828.9	1035909.1
	419107.7	573384.7	740887.5	908741.1
	-0.7	0.4	0.4	1.1
PI	-340724.8	-686967.6	-785978.4	-1014131.6
	200031.9	253705.9	306973.0	345230.0
	-1.7	-2.7	-2.6	-2.9
NCPROF	4556157.0	6487753.0	8089337.2	8884873.6
	407474.7	499181.5	632626.7	689159.0
	11.2	13.0	12.8	12.9
Total8	4582273.7	7121090.1	9489225.2	12020815.5
	572227.4	779944.1	1000502.0	1184794.2
	8.0	9.1	9.5	10.1

.....Continued Table 5A.16

UNR	850653.8	1104373.3	1393565.1	1710596.9
	121522.0	139794.1	193550.7	228079.6
	7.0	7.9	7.2	7.5
Total9	1133389.3	1508402.2	1817292.4	2169029.6
	157415.2	193384.9	242305.7	278080.7
	7.2	7.8	7.5	7.8
$\hat{\sigma}^2$	81272312.3	91156376.8	103047000.0	110571000.0
$[\widehat{var}(\hat{\sigma}^2)]^{1/2}$	3533261.9	3823444.4	4454533.0	4862276.0
ζ_b	23.0	23.8	23.1	22.7

TABLE 5A.17

Precision of The Stochastic Simulation Estimates For Real GDP

METHOD 3 (Bootstrapping)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	-423575.1	2418776.7	4507445.2	6332260.2
	47173.9	232247.7	340777.7	500757.8
	-9.0	10.4	13.2	12.6
CND	1889326.8	2239462.3	3553884.6	3261686.0
	275208.8	370299.8	413634.8	455987.2
	6.9	6.0	8.6	7.2
CSD	1219926.8	1395241.5	1965044.6	2188369.5
	133019.7	169668.4	201274.3	238619.0
	9.2	8.2	9.8	9.2
CS	2188805.8	2955945.1	3278475.3	3516562.1
	190990.3	267524.0	332359.0	399617.9
	11.5	11.0	9.9	8.8
Totall	4939227.4	9081440.7	13319411.2	15344009.2
	445244.5	648443.0	872881.8	1083678.2
	11.1	14.0	15.3	14.2
BGFIR	913770.6	2608246.6	3292550.7	3296253.3
	268249.5	355025.2	441707.4	459649.3
	3.4	7.3	7.5	7.2
BGFINR	903045.8	2748068.9	3567318.7	4415563.2
	318141.6	470444.2	571793.1	676612.2
	2.8	5.8	6.2	6.5
BGFIME	1970223.3	4008452.4	6273284.2	8697893.3
	326175.7	483636.4	722726.7	882859.0
	6.0	8.3	8.7	9.9

.......Continued Table 5A.17

Total2	3917501.5	9472133.4	13185214.1	16506033.5
	681617.9	942767.6	1279163.6	1443331.5
	5.7	10.0	10.3	11.4
INVNF	-1031952.5	-1828695.1	-1276236.3	-1260778.4
	980045.4	1332925.8	1423286.5	1766476.7
	-1.1	-1.4	-0.9	-0.7
Total3	-1208473.1	-1809041.7	-1320618.1	-1666558.9
	991576.3	1349590.5	1434348.6	1791876.9
	-1.2	-1.3	-0.9	-0.9
IM	1406208.8	5173467.0	6500019.0	7114764.4
	882152.2	1279421.4	1562261.3	1944241.4
	1.6	4.0	4.2	3.7
X	14202100.8	14705853.9	19118855.1	26002214.4
	1063096.2	1378785.1	1745765.4	2284630.6
	13.4	10.7	11.0	11.4
Total4	15013010.1	19734008.3	25204165.4	32906233.5
	989376.2	1398010.6	1850607.4	2192927.0
	15.2	14.1	13.6	15.0
Total5	22235529.7	36401503.6	50006240.1	62908066.3
	920353.0	1586180.8	2293539.1	2915409.1
	24.2	22.9	21.8	21.6
G	227355.6	907098.4	433147.3	394044.3
	224965.1	308793.1	353264.2	437207.2
	1.0	2.9	1.2	0.9
OG	-154573.9	-75795.1	122808.2	371367.9
	58694.2	126005.2	155873.6	218869.2
	-2.6	-0.6	0.8	1.7
Total6	76869.4	831696.6	552086.4	759192.9
	231116.8	338523.5	386473.0	497736.6
	0.3	2.5	1.4	1.5
ER	51310.8	3606.3	70114.5	397678.5
	26741.4	89404.9	166193.8	248729.8
	1.9	0.0	0.4	1.6

.......Continued Table 5A.17

NT	134475.5	567360.6	744736.4	1180861.8
	46855.4	125895.9	236651.5	324461.7
	2.9	4.5	3.1	3.6
HM	0.0	-16500.9	-54178.8	-114062.0
	0.0	3113.4	9182.8	17548.0
	--	-5.3	-5.9	-6.5
Total7	185773.6	553250.4	764531.0	1467949.0
	44231.8	204907.6	173757.0	699023.3
	4.2	2.7	4.4	2.1
P	-13885.1	-33610.4	-56288.1	-88876.4
	3752.7	42013.0	31271.2	20668.9
	-3.7	-0.8	-1.8	-4.3
W	124561.0	283838.4	376729.1	440419.9
	17063.2	41740.9	53818.4	62031.0
	7.3	6.8	7.0	7.1
PIM	36535.8	-52172.0	-69271.0	-344539.0
	60893.0	16303.8	13321.3	137815.6
	0.6	-3.2	-5.2	-2.5
PI	49586.5	-45436.4	-150580.0	-227429.0
	99173.0	75727.3	125483.3	108299.5
	0.5	-0.6	-1.2	-2.1
NCPROF	4639.2	538242.0	1430991.0	2721599.0
	828.4	66449.6	133737.5	219483.8
	5.6	8.1	10.7	12.4
Total8	201089.6	686215.9	1522046.0	2498411.0
	47878.5	108923.2	281860.4	337623.1
	4.2	6.3	5.4	7.4
UNR	101581.7	298123.0	466323.8	749733.1
	13727.3	46581.7	64767.2	88203.9
	7.4	6.4	7.2	8.5
Total9	165517.5	425452.6	652048.8	1001350.2
	18162.9	46988.6	76778.6	116408.5
	9.1	9.1	8.5	8.6

.......Continued Table 5A.17

$\hat{\sigma}^2$	22869727.1	38902258.8	53496992.6	68605342.7
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	888332.5	1604029.2	2361781.9	3086335.6
ζ_b	25.7	24.3	22.7	22.2

	Quarters Ahead			
	5	6	7	8
Shocks				
CD	7438976.9	8263053.3	9676547.0	10803052.0
	556938.2	646877.3	722282.6	779255.1
	13.4	12.8	13.4	13.9
CND	3591312.6	3936414.8	2632697.8	3832201.5
	504615.0	549516.0	620061.8	633483.2
	7.1	7.2	4.2	6.0
CSD	2261838.8	2672421.5	2062502.4	2597509.7
	220867.7	266897.4	300953.5	298219.4
	10.2	10.0	6.9	8.7
CS	3167404.5	4340127.5	4272852.8	4289870.0
	419483.5	475848.5	486565.1	520745.3
	7.6	9.1	8.8	8.2
Totall	16515994.1	19237611.0	18682489.4	21525838.0
	1113573.1	1299376.6	1393042.6	1513323.3
	14.8	14.8	13.4	14.2
BGFIR	2478754.4	2992581.7	2164420.5	3121434.0
	462349.0	488530.8	516077.7	548362.1
	5.4	6.1	4.2	5.7

.......Continued Table 5A.17

BGFINR	4861568.6	5936841.8	5799211.2	6032984.5
	739224.2	913627.8	901445.7	884904.5
	6.6	6.5	6.4	6.8
BGFIME	9482059.7	13085719.7	11304885.5	12302746.2
	898991.1	1196084.8	1216938.2	1302948.9
	10.5	10.9	9.3	9.4
Total2	16835254.3	22079149.9	19292426.2	21465666.9
	1524029.7	1907240.2	1884120.0	1969011.3
	11.0	11.6	10.2	10.9
INVNF	-2479692.5	1223581.2	5071011.4	211367.5
	1736887.1	1773580.1	2291417.0	2170740.2
	-1.4	0.7	2.2	0.1
Total3	-2557997.9	1293979.5	4878687.2	-45083.6
	1778103.9	1792711.1	2340462.4	2198969.0
	-1.4	0.7	2.1	-0.0
IM	11368775.7	6930396.4	10421102.1	11192062.3
	2355574.7	2363212.8	2581294.8	2633803.5
	4.8	2.9	4.0	4.2
X	26228805.6	30457090.8	33023356.6	35836746.7
	2338697.6	2589993.1	2776528.2	2969194.4
	11.2	11.8	11.9	12.1
Total4	37281234.4	37170963.7	43066843.1	47246554.8
	2593327.8	2693032.1	2842589.4	3106162.8
	14.4	13.8	15.2	15.2
Total5	68161237.9	79604231.7	86053494.6	90224381.0
	3037374.6	3549580.2	3808226.2	4133032.6
	22.4	22.4	22.6	21.8
G	1456210.4	1043206.4	1050772.2	1022312.2
	448029.3	515676.0	566118.1	570962.6
	3.3	2.0	1.9	1.8
OG	727941.0	695985.0	535146.5	83528.0
	260170.7	305893.7	345309.5	383856.3
	2.8	2.3	1.5	0.2

.......Continued Table 5A.17

Total6	2177143.7	1749342.1	1589014.8	1094528.1
	550430.4	631836.5	682046.6	706514.0
	4.0	2.8	2.3	1.5
ER	-54797.1	206600.0	826416.5	388890.2
	331179.6	417554.7	509548.7	554612.5
	-0.2	0.5	1.6	0.7
NT	1683571.1	1828818.9	2761917.1	2336320.9
	437187.6	566185.1	653151.1	749749.3
	3.9	3.2	4.2	3.1
HM	-151619.0	-198950.0	-195980.0	-200815.0
	20769.7	25183.5	23900.0	23906.5
	-7.3	-7.9	-8.2	-8.4
Total7	1490541.0	1838721.0	3368770.0	2516037.0
	876788.8	967747.9	1464682.6	931865.6
	1.7	1.9	2.3	2.7
P	24671.5	344280.3	576840.9	887314.1
	82238.2	245914.5	164811.7	158448.9
	0.3	1.4	3.5	5.6
W	592973.6	712460.5	1139597.0	1504325.0
	98828.9	122838.0	237416.0	231434.6
	6.0	5.8	4.8	6.5
PIM	49530.8	899905.1	366565.8	1916008.0
	99061.6	1124881.4	407295.3	1277338.7
	0.5	0.8	0.9	1.5
PI	-177858.0	-275121.0	-250235.0	-557150.0
	84694.3	91707.0	89369.6	168833.3
	-2.1	-3.0	-2.8	-3.3
NCPROF	3868742.0	5787322.0	6720942.0	8795223.0
	361564.7	448629.6	513049.0	692537.2
	10.7	12.9	13.1	12.7
Total8	4368018.0	7458967.0	8586945.0	12565856.0
	552913.7	838086.2	885252.1	1208255.4
	7.9	8.9	9.7	10.4

.......Continued Table 5A.17

UNR	868688.2	1207234.0	1460367.0	1841316.0
	122350.5	152814.4	192153.6	221845.3
	7.1	7.9	7.6	8.3
Total9	1152394.1	1522998.5	1778625.4	2277338.1
	144980.2	193802.2	237998.3	286949.9
	7.9	7.9	7.5	7.9
$\hat{\theta}^2$	77336297.6	92133348.8	101320000.0	108661000.0
$[\hat{var}(\hat{\theta}^2)]^{1/2}$	3376890.9	3974124.3	4327248.5	4828112.3
ζ_b	22.9	23.2	23.4	22.5

TABLE 5A.18

Precision of The Stochastic Simulation Estimates For Rate of Unemployment

METHOD 3 (Fair's Technique)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	0.00	-8.10E-08	2.98E-07	1.01E-06
	0.00	1.04E-08	4.67E-08	1.19E-07
	--	6.4	8.5	8.7
CND	0.00	2.50E-07	5.48E-07	9.10E-07
	0.00	6.59E-08	1.31E-07	2.09E-07
	--	4.2	4.4	6.6
CSD	0.00	1.31E-07	3.36E-07	6.62E-07
	0.00	2.89E-08	5.91E-08	9.65E-08
	--	5.7	6.9	7.8
CS	0.00	1.91E-07	6.02E-07	1.41E-06
	0.00	5.56E-08	1.18E-07	1.78E-07
	--	5.1	7.9	8.2
Total1	0.00	5.38E-07	1.90E-06	4.15E-06
	0.00	9.65E-08	2.26E-07	4.18E-07
	--	8.4	9.9	10.5
BGFIR	0.00	2.63E-07	7.59E-07	1.60E-06
	0.00	6.53E-08	1.37E-07	2.14E-07
	--	5.5	7.5	7.8
BGFINR	0.00	3.38E-07	9.61E-07	1.57E-06
	0.00	8.22E-08	1.76E-07	3.02E-07
	--	5.5	5.2	3.7
BGFIME	0.00	7.88E-07	1.97E-06	4.03E-06
	0.00	1.03E-07	2.28E-07	3.95E-07
	--	8.6	10.2	8.7

.......Continued Table 5A.18

Total2	0.00	1.63E-06	4.03E-06	6.16E-06
	0.00	2.24E-07	4.86E-07	7.08E-07
	--	7.3	8.3	8.7
INVNF	0.00	-8.70E-08	-7.26E-07	-1.32E-06
	0.00	3.02E-07	4.85E-07	6.17E-07
	--	-1.5	-2.1	-3.7
Total3	0.00	-1.66E-07	-9.88E-07	-1.71E-06
	0.00	3.03E-07	4.88E-07	6.29E-07
	--	-2.0	-2.7	-3.7
IM	0.00	-2.87E-06	-5.37E-06	-7.90E-06
	0.00	3.03E-07	6.30E-07	9.79E-07
	--	-8.5	-8.1	-6.5
X	0.00	2.94E-06	5.71E-06	9.74E-06
	0.00	3.28E-07	5.92E-07	9.46E-07
	--	9.6	10.3	10.7
Total4	0.00	6.32E-08	3.58E-07	1.80E-06
	0.00	3.15E-07	5.91E-07	9.52E-07
	--	0.6	1.9	4.4
Total5	0.00	1.82E-06	4.86E-06	1.13E-05
	0.00	2.34E-07	4.95E-07	9.28E-07
	--	9.8	12.1	13.5
G	0.00	-3.44E-07	-7.55E-07	-1.15E-06
	0.00	6.98E-08	1.32E-07	1.92E-07
	--	-5.7	-6.0	-5.2
OG	2.95E-30	-8.46E-08	-6.23E-08	-6.59E-08
	0.00E+00	2.42E-08	5.35E-08	9.42E-08
	3.5	-1.2	-0.7	-1.5
Total6	0.00	-4.27E-07	-8.18E-07	-1.22E-06
	0.00	7.94E-08	1.55E-07	2.31E-07
	--	-5.3	-5.3	-5.2
ER	0.00	-1.18E-08	-6.30E-08	-8.90E-08
	0.00	9.22E-09	3.37E-08	7.54E-08
	--	-1.9	-1.2	-0.8

.......Continued Table 5A.18

NT	0.00	-7.40E-08	-2.27E-07	-3.38E-07
	0.00	1.52E-08	5.41E-08	1.10E-07
	--	-4.2	-3.1	-4.2
HM	0.00	3.24E-31	-4.11E-09	-1.08E-08
	0.00	0.00E+00	1.54E-09	3.64E-09
	--	3.0	-0.7	-2.8
Total7	0.00	-8.70E-08	-2.95E-07	-4.41E-07
	0.00	1.73E-08	6.31E-08	1.35E-07
	--	-4.7	-3.3	-4.1
P	0.00	2.97E-09	1.51E-08	1.09E-08
	0.00	1.38E-09	5.96E-09	1.41E-08
	--	2.5	0.8	0.1
W	0.00	1.92E-08	8.07E-08	1.68E-07
	0.00	4.99E-09	1.44E-08	2.95E-08
	--	5.6	5.7	6.4
PIM	0.00	1.23E-08	2.11E-08	-3.35E-08
	0.00	1.13E-08	3.91E-08	8.96E-08
	--	0.5	0.4	-0.2
PI	0.00	-4.12E-08	-1.35E-07	-3.25E-07
	0.00	7.92E-09	2.35E-08	5.16E-08
	--	-5.8	-6.3	-3.8
NCPROF	0.00	3.69E-10	1.09E-07	4.82E-07
	0.00	5.27E-10	1.79E-08	6.08E-08
	--	6.1	7.9	6.9
Total8	0.00	-5.11E-09	8.44E-08	2.98E-07
	0.00	1.35E-08	4.71E-08	1.15E-07
	--	1.8	2.6	3.5
UNR	2.35E-05	4.15E-05	5.77E-05	7.05E-05
	9.99E-07	1.86E-06	2.76E-06	3.36E-06
	23.5	22.4	20.9	21.0
Total9	2.35E-05	4.15E-05	5.77E-05	7.05E-05
	9.99E-07	1.86E-06	2.75E-06	3.36E-06
	23.5	22.4	20.9	21.0

.......Continued Table 5A.18

$\hat{\sigma}^2$	2.3E-05	4.3E-05	6.2E-05	8.0E-05
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	1.0E-06	1.9E-06	2.9E-06	3.8E-06
ζ_b	23.5	22.5	21.4	21.3

	Quarters Ahead			
	5	6	7	8
Shocks				
CD	2.05E-06	3.62E-06	5.68E-06	7.83E-06
	2.02E-07	3.10E-07	4.23E-07	5.38E-07
	10.2	11.7	13.4	14.6
CND	1.60E-06	2.49E-06	3.52E-06	4.37E-06
	2.92E-07	3.62E-07	4.47E-07	5.22E-07
	5.5	6.9	7.9	8.4
CSD	1.09E-06	1.63E-06	2.21E-06	2.72E-06
	1.29E-07	1.65E-07	1.98E-07	2.30E-07
	8.5	9.9	11.1	11.8
CS	2.00E-06	2.78E-06	3.21E-06	4.01E-06
	2.56E-07	3.55E-07	4.11E-07	4.63E-07
	7.8	7.8	7.8	8.7
Totall	6.90E-06	1.06E-05	1.46E-05	1.88E-05
	6.10E-07	8.45E-07	1.06E-06	1.25E-06
	11.3	12.6	13.8	15.1
BGFIR	2.40E-06	3.00E-06	3.25E-06	3.91E-06
	2.86E-07	3.35E-07	3.83E-07	4.17E-07
	8.4	9.0	8.5	9.4

.......Continued Table 5A.18

BGFINR	2.55E-06	3.68E-06	5.13E-06	6.29E-06
	4.49E-07	5.83E-07	7.21E-07	8.32E-07
	5.7	6.3	7.1	7.6
BGFIME	6.06E-06	8.81E-06	1.09E-05	1.28E-05
	5.59E-07	7.61E-07	9.37E-07	1.11E-06
	10.8	11.6	11.6	11.6
Total2	1.02E-05	1.36E-05	1.67E-05	1.98E-05
	1.05E-06	1.28E-06	1.40E-06	1.63E-06
	9.7	10.6	11.9	12.2
INVNF	-3.48E-06	-5.20E-06	-7.17E-06	-9.09E-06
	7.80E-07	8.35E-07	9.78E-07	1.14E-06
	-4.5	-6.2	-7.3	-8.0
Total3	-3.96E-06	-6.05E-06	-8.22E-06	-1.03E-05
	8.11E-07	8.75E-07	1.01E-06	1.18E-06
	-4.9	-6.9	-8.1	-8.7
IM	-1.07E-05	-1.21E-05	-1.16E-05	-1.24E-05
	1.38E-06	1.85E-06	2.27E-06	2.63E-06
	-7.8	-6.5	-5.1	-4.7
X	1.64E-05	2.31E-05	2.95E-05	3.60E-05
	1.38E-06	1.89E-06	2.28E-06	2.67E-06
	11.8	12.2	12.9	13.5
Total4	5.47E-06	1.08E-05	1.75E-05	2.33E-05
	1.38E-06	1.80E-06	2.22E-06	2.69E-06
	3.9	6.0	7.9	8.7
Total5	1.93E-05	3.06E-05	4.28E-05	5.43E-05
	1.41E-06	2.02E-06	2.50E-06	3.03E-06
	13.7	15.2	17.1	17.9
G	-1.28E-06	-1.51E-06	-1.44E-06	-1.44E-06
	2.38E-07	2.85E-07	3.44E-07	4.03E-07
	-5.4	-5.3	-4.2	-3.6
OG	-5.19E-08	-5.08E-08	1.08E-07	1.20E-07
	1.53E-07	2.09E-07	2.55E-07	3.09E-07
	-0.3	-0.2	-0.4	0.4

.......Continued Table 5A.18

Total6	-1.33E-06	-1.57E-06	-1.33E-06	-1.32E-06
	2.99E-07	3.71E-07	4.32E-07	5.22E-07
	-4.5	-4.2	-3.1	-2.5
ER	-1.66E-07	-2.36E-07	-2.17E-07	-2.29E-07
	1.32E-07	2.03E-07	2.89E-07	3.90E-07
	-1.3	-1.2	-0.8	-0.6
NT	-6.77E-07	-9.22E-07	-1.08E-06	-1.43E-06
	1.84E-07	2.95E-07	4.13E-07	5.45E-07
	-3.7	-3.1	-2.6	-2.6
HM	-2.41E-08	-5.58E-08	-1.07E-07	-1.59E-07
	7.41E-09	1.27E-08	2.00E-08	2.74E-08
	-3.3	-4.4	-5.4	-5.8
Total7	-8.70E-07	-1.21E-06	-1.40E-06	-1.81E-06
	2.27E-07	3.62E-07	5.04E-07	6.51E-07
	-3.8	-3.3	-2.8	-2.8
P	1.58E-08	7.89E-09	4.13E-08	6.79E-08
	2.36E-08	2.79E-08	3.43E-08	6.94E-08
	0.7	0.3	1.2	1.0
W	2.95E-07	4.36E-07	7.30E-07	1.16E-06
	4.85E-08	7.89E-08	1.26E-07	1.92E-07
	6.1	5.5	5.8	6.0
PIM	-5.15E-08	-1.84E-07	-1.19E-07	1.79E-07
	1.67E-07	2.74E-07	4.11E-07	5.94E-07
	-0.3	-0.7	-0.3	0.3
PI	-5.30E-07	-7.49E-07	-1.08E-06	-1.56E-06
	9.28E-08	1.44E-07	2.02E-07	2.76E-07
	-5.7	-5.2	-5.4	-5.7
NCPROF	1.09E-06	2.07E-06	3.59E-06	5.51E-06
	1.25E-07	2.19E-07	3.37E-07	4.77E-07
	8.7	9.4	10.7	11.5
Total8	8.15E-07	1.59E-06	3.16E-06	5.35E-06
	2.15E-07	3.65E-07	5.46E-07	7.82E-07
	3.8	4.3	5.8	6.8

......Continued Table 5A.18

UNR	8.23E-05	9.08E-05	9.83E-05	1.06E-04
	4.07E-06	4.54E-06	5.00E-06	5.36E-06
	20.2	20.0	19.7	19.8
Total9	8.23E-05	9.08E-05	9.83E-05	1.06E-04
	4.07E-06	4.54E-06	5.00E-06	5.36E-06
	20.2	20.0	19.7	19.8
$\hat{\sigma}^2$	1.0E-04	1.2E-04	1.4E-04	1.6E-04
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	4.7E-06	5.7E-06	6.6E-06	7.4E-06
ζ_b	21.1	21.0	21.4	22.0

TABLE 5A.19

Precision of The Stochastic Simulation Estimates For Rate of Unemployment

METHOD 3 (Bootstrapping)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	0.00E-30	-9.50E-08	3.57E-07	1.14E-06
	0.00E+00	1.06E-08	5.06E-08	1.32E-07
	--	-9.0	7.0	8.7
CND	0.00E-30	3.93E-07	8.54E-07	1.45E-06
	0.00E+00	6.96E-08	1.38E-07	2.19E-07
	--	5.7	6.2	6.6
CSD	0.00E-30	2.09E-07	4.30E-07	8.01E-07
	0.00E+00	3.22E-08	6.46E-08	1.02E-07
	--	6.5	6.7	7.8
CS	0.00E-30	3.17E-07	8.52E-07	1.44E-06
	0.00E+00	5.57E-08	1.10E-07	1.77E-07
	--	5.7	7.7	8.2
Total1	0.00E-30	8.25E-07	2.48E-06	4.80E-06
	0.00E+00	1.10E-07	2.74E-07	4.58E-07
	--	7.5	9.0	10.5
BGFIR	0.00E-30	4.55E-07	1.26E-06	1.96E-06
	0.00E+00	8.62E-08	1.79E-07	2.52E-07
	--	5.3	7.0	7.8
BGFINR	0.00E-30	3.77E-07	9.24E-07	1.30E-06
	0.00E+00	9.43E-08	2.13E-07	3.49E-07
	--	4.0	4.3	3.7
BGFIME	0.00E-30	8.98E-07	1.96E-06	3.38E-06
	0.00E+00	1.13E-07	2.37E-07	3.88E-07
	--	7.9	8.3	8.7

.......Continued Table 5A.19

Total2	0.00E-30	1.74E-06	4.14E-06	6.65E-06
	0.00E+00	2.32E-07	5.04E-07	7.50E-07
	--	7.5	8.2	8.9
INVNF	0.00E-30	-4.75E-07	-1.04E-06	-2.32E-06
	0.00E+00	2.67E-07	4.51E-07	6.26E-07
	--	-1.8	-2.3	-3.7
Total3	0.00E-30	-4.94E-07	-1.05E-06	-2.42E-06
	0.00E+00	2.73E-07	4.68E-07	6.53E-07
	--	-1.8	-2.3	-3.7
IM	0.00E-30	-2.40E-06	-4.85E-06	-6.48E-06
	0.00E+00	3.43E-07	6.70E-07	9.99E-07
	--	-7.0	-7.2	-6.5
X	0.00E-30	2.95E-06	6.65E-06	1.09E-05
	0.00E+00	3.34E-07	6.17E-07	1.02E-06
	--	8.8	10.8	10.7
Total4	0.00E-30	5.02E-07	1.78E-06	4.48E-06
	0.00E+00	3.42E-07	6.63E-07	1.02E-06
	--	1.5	2.7	4.4
Total5	0.00E-30	2.59E-06	7.38E-06	1.36E-05
	0.00E+00	2.54E-07	5.74E-07	1.01E-06
	--	10.2	12.8	13.5
G	0.00E-30	-3.43E-07	-6.29E-07	-9.88E-07
	0.00E+00	6.93E-08	1.33E-07	1.88E-07
	--	-5.0	-4.7	-5.2
OG	0.00E-30	-6.34E-08	-1.23E-07	-1.37E-07
	0.00E+00	2.16E-08	5.25E-08	8.96E-08
	--	-2.9	-2.3	-1.5
Total6	0.00E-30	-4.10E-07	-7.52E-07	-1.13E-06
	0.00E+00	7.76E-08	1.54E-07	2.18E-07
	--	-5.3	-4.9	-5.2
ER	0.00E-30	-5.20E-09	-1.98E-08	-5.98E-08
	0.00E+00	9.01E-09	3.39E-08	7.34E-08
	--	-0.6	-0.6	-0.8

.......Continued Table 5A.19

NT	0.00E-30	-5.50E-08	-2.19E-07	-4.62E-07
	0.00E+00	1.59E-08	5.22E-08	1.11E-07
	--	-3.5	-4.2	-4.2
HM	0.00E-30	3.24E-31	1.44E-09	1.24E-08
	0.00E+00	0.00E+00	1.93E-09	4.42E-09
	--	--	0.7	2.8
Total7	0.00E-30	-6.04E-08	-2.36E-07	-5.33E-07
	0.00E+00	1.77E-08	5.99E-08	1.31E-07
	--	-3.4	-3.9	-4.1
P	0.00E-30	6.76E-10	9.57E-09	1.90E-09
	0.00E+00	1.59E-09	6.93E-09	1.45E-08
	--	0.4	1.4	0.1
W	0.00E-30	3.70E-08	1.18E-07	2.03E-07
	0.00E+00	5.54E-09	1.68E-08	3.19E-08
	--	6.7	7.0	6.4
PIM	0.00E-30	5.47E-09	3.51E-08	2.30E-08
	0.00E+00	1.14E-08	3.95E-08	9.21E-08
	--	0.5	0.9	0.2
PI	0.00E-30	-4.13E-08	-1.23E-07	-2.02E-07
	0.00E+00	8.34E-09	2.47E-08	5.38E-08
	--	-5.0	-5.0	-3.8
NCPROF	0.00E-30	9.42E-10	1.22E-07	4.08E-07
	0.00E+00	5.94E-10	1.76E-08	5.93E-08
	--	1.6	6.9	6.9
Total8	0.00E-30	1.89E-09	1.46E-07	4.31E-07
	0.00E+00	1.31E-08	4.83E-08	1.22E-07
	--	0.1	3.0	3.5
UNR	2.40E-05	4.33E-05	5.74E-05	7.28E-05
	1.49E-06	2.58E-06	3.53E-06	4.27E-06
	16.2	16.8	16.3	17.0
Total9	2.40E-05	4.33E-05	5.74E-05	7.28E-05
	1.49E-06	2.58E-06	3.53E-06	4.27E-06
	16.2	16.8	16.3	17.0

.......Continued Table 5A.19

$\hat{\sigma}^2$	2.40E-05	4.54E-05	6.40E-05	8.51E-05
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	1.49E-06	2.68E-06	3.89E-06	4.89E-06
ζ_b	16.2	16.9	16.5	17.4

	Quarters Ahead			
	5	6	7	8
Shocks				
CD	2.33E-06	3.83E-06	5.30E-06	6.81E-06
	2.37E-07	3.61E-07	4.93E-07	6.03E-07
	9.8	10.6	10.8	11.3
CND	1.84E-06	2.45E-06	2.74E-06	3.54E-06
	2.80E-07	3.81E-07	4.58E-07	5.31E-07
	6.6	6.4	6.0	6.7
CSD	1.15E-06	1.57E-06	1.88E-06	2.31E-06
	1.32E-07	1.76E-07	2.09E-07	2.45E-07
	8.7	8.9	9.0	9.4
CS	1.94E-06	2.79E-06	3.60E-06	4.44E-06
	2.42E-07	3.11E-07	3.94E-07	4.50E-07
	8.0	9.0	9.1	9.9
Totall	7.21E-06	1.05E-05	1.34E-05	1.69E-05
	6.40E-07	9.05E-07	1.10E-06	1.34E-06
	11.3	11.7	12.2	12.6
BGFIR	2.37E-06	2.76E-06	2.87E-06	3.08E-06
	2.98E-07	3.39E-07	3.81E-07	4.25E-07
	8.0	8.1	7.5	7.3

.......Continued Table 5A.19

BGFINR	2.20E-06	3.16E-06	4.06E-06	4.91E-06
	4.67E-07	6.29E-07	7.21E-07	8.02E-07
	4.7	5.0	5.6	6.1
BGFIME	5.26E-06	7.92E-06	1.04E-05	1.23E-05
	5.60E-07	7.65E-07	9.02E-07	1.07E-06
	9.4	10.4	11.5	11.5
Total2	9.85E-06	1.38E-05	1.74E-05	2.03E-05
	9.90E-07	1.29E-06	1.44E-06	1.65E-06
	9.9	10.8	12.0	12.3
INVNF	-2.99E-06	-4.11E-06	-4.67E-06	-6.88E-06
	7.21E-07	8.53E-07	9.07E-07	1.05E-06
	-4.1	-4.8	-5.2	-6.5
Total3	-3.28E-06	-4.61E-06	-5.40E-06	-7.89E-06
	7.56E-07	8.94E-07	9.48E-07	1.10E-06
	-4.3	-5.2	-5.7	-7.1
IM	-9.19E-06	-1.15E-05	-1.37E-05	-1.43E-05
	1.36E-06	1.89E-06	2.29E-06	2.61E-06
	-6.7	-6.1	-6.0	-5.5
X	1.66E-05	2.25E-05	2.94E-05	3.79E-05
	1.42E-06	1.88E-06	2.37E-06	2.94E-06
	11.8	12.0	12.4	12.9
Total4	7.57E-06	1.13E-05	1.60E-05	2.43E-05
	1.36E-06	1.86E-06	2.18E-06	2.62E-06
	5.5	6.1	7.4	9.2
Total5	2.14E-05	3.13E-05	4.14E-05	5.34E-05
	1.43E-06	1.94E-06	2.47E-06	3.03E-06
	15.0	16.1	16.8	17.6
G	-1.37E-06	-1.62E-06	-1.88E-06	-1.91E-06
	2.36E-07	3.07E-07	3.99E-07	4.54E-07
	-5.8	-5.3	-4.7	-4.2
OG	-1.42E-07	1.84E-07	3.58E-07	5.37E-07
	1.32E-07	1.93E-07	2.47E-07	3.35E-07
	-1.1	1.0	1.5	1.6

.......Continued Table 5A.19

Total6	-1.51E-06	-1.43E-06	-1.52E-06	-1.38E-06
	2.89E-07	3.89E-07	5.06E-07	5.99E-07
	-5.2	-3.7	-3.0	-2.3
ER	-8.26E-08	1.29E-07	1.74E-07	5.69E-07
	1.24E-07	2.08E-07	2.95E-07	4.12E-07
	-0.7	0.6	0.6	1.4
NT	-8.35E-07	-1.09E-06	-1.39E-06	-1.86E-06
	1.85E-07	2.78E-07	4.08E-07	5.69E-07
	-4.5	-3.9	-3.4	-3.3
HM	-2.69E-08	-3.75E-08	-8.00E-08	-1.30E-07
	8.55E-09	1.45E-08	2.15E-08	2.67E-08
	-3.1	-2.6	-3.7	-4.9
Total7	-9.44E-07	-1.01E-06	-1.30E-06	-1.42E-06
	2.23E-07	3.50E-07	5.03E-07	7.31E-07
	-4.2	-2.9	-2.6	-1.9
P	1.97E-09	1.44E-09	6.36E-08	2.27E-07
	2.24E-08	2.63E-08	3.85E-08	7.57E-08
	0.1	0.1	1.7	3.0
W	3.72E-07	5.87E-07	8.45E-07	1.13E-06
	4.90E-08	8.10E-08	1.15E-07	1.62E-07
	7.6	7.2	7.4	7.0
PIM	1.22E-07	3.50E-09	1.03E-07	-3.14E-07
	1.61E-07	2.66E-07	4.13E-07	5.67E-07
	0.8	0.0	0.2	-0.6
PI	-4.30E-07	-5.66E-07	-7.91E-07	-1.01E-06
	8.82E-08	1.37E-07	1.95E-07	2.59E-07
	-4.9	-4.1	-4.1	-3.9
NCPROF	1.02E-06	1.96E-06	3.07E-06	4.42E-06
	1.20E-07	2.07E-07	3.12E-07	4.36E-07
	8.5	9.5	9.8	10.1
Total8	1.09E-06	1.98E-06	3.32E-06	4.48E-06
	2.16E-07	3.68E-07	5.54E-07	7.66E-07
	5.0	5.4	6.0	5.8

.......Continued Table 5A.19

UNR	7.89E-05	9.49E-05	1.04E-04	1.06E-04
	4.54E-06	5.68E-06	5.79E-06	5.69E-06
	17.4	16.7	17.9	18.7
Total9	7.89E-05	9.49E-05	1.04E-04	1.06E-04
	4.54E-06	5.68E-06	5.79E-06	5.69E-06
	17.4	16.7	17.9	18.7
$\hat{\sigma}^2$	9.89E-05	1.26E-04	1.46E-04	1.61E-04
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	5.34E-06	6.79E-06	7.08E-06	7.69E-06
ζ_b	18.5	18.5	20.5	21.0

TABLE 5A.20

Precision of The Stochastic Simulation Estimates For Rate of Inflation

METHOD 3 (Bootstrapping)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	0.000E-32	-2.704E-08	2.611E-08	4.157E-07
	0	1.890E-08	8.197E-08	2.472E-07
	--	-1.43086	0.31856	1.68161
CND	0.000E-32	-9.689E-08	4.629E-08	3.330E-07
	0	1.527E-07	3.475E-07	4.525E-07
	--	-0.63446	0.13323	0.73599
CSD	0.000E-32	8.004E-08	2.144E-07	2.178E-07
	0	5.791E-08	1.347E-07	1.897E-07
	--	1.38217	1.59106	1.14785
CS	0.000E-32	2.826E-07	1.006E-06	1.755E-06
	0	1.134E-07	2.472E-07	3.338E-07
	--	2.49213	4.06833	5.2571
Total1	0.000E-32	2.457E-07	1.300E-06	2.724E-06
	0	2.306E-07	5.674E-07	8.171E-07
	--	1.06544	2.29063	3.33379
BGFIR	0.000E-32	5.766E-07	1.918E-06	3.031E-06
	0	1.414E-07	3.125E-07	4.223E-07
	--	4.07818	6.13679	7.17593
BGFINR	0.000E-32	7.955E-08	3.617E-07	8.157E-07
	0	1.837E-07	4.092E-07	6.050E-07
	--	0.43303	0.88387	1.34833
BGFIME	0.000E-32	1.304E-07	8.226E-07	1.643E-06
	0	1.925E-07	4.570E-07	7.081E-07
	--	0.67706	1.80013	2.32017

......Continued Table 5A.20

Total2	0.000E-32	7.887E-07	3.124E-06	5.510E-06
	0	3.500E-07	8.052E-07	1.166E-06
	--	2.25319	3.87943	4.72705
INVNF	0.000E-32	6.552E-07	5.029E-07	-1.398E-06
	0	5.403E-07	1.048E-06	1.236E-06
	--	1.2125	0.47962	1.1309
Total3	0.000E-32	6.018E-07	3.107E-07	-1.622E-06
	0	5.404E-07	1.059E-06	1.248E-06
	--	1.11363	0.2934	1.29951
IM	0.000E-32	4.347E-07	2.195E-06	3.975E-06
	0	5.134E-07	1.212E-06	1.699E-06
	--	0.84673	1.81082	2.34036
X	0.000E-32	-1.349E-06	-1.954E-06	1.485E-07
	0	6.116E-07	1.353E-06	1.788E-06
	--	-2.20634	-1.4444	0.08304
Total4	0.000E-32	-1.087E-06	-1.253E-07	3.714E-06
	0	6.303E-07	1.370E-06	1.779E-06
	--	-1.72413	-0.09143	2.08831
Total5	0.000E-32	4.181E-07	4.482E-06	0.00001028
	0	4.864E-07	1.102E-06	1.729E-06
	--	0.8595	4.06897	5.9472
G	0.000E-32	-4.082E-07	-7.077E-07	-5.953E-07
	0	1.479E-07	3.171E-07	4.125E-07
	--	-2.75946	-2.23185	-1.4433
OG	0.000E-32	-4.732E-08	-1.642E-07	9.976E-09
	0	4.230E-08	1.130E-07	1.834E-07
	--	-1.11876	-1.4525	0.05441
Total6	0.000E-32	-4.507E-07	-8.717E-07	-5.911E-07
	0	1.595E-07	3.448E-07	4.600E-07
	--	-2.82582	-2.52854	-1.28501
ER	0.000E-32	-3.516E-07	-7.548E-07	3.331E-07
	0	5.616E-08	4.015E-07	1.066E-06
	--	-6.261	-1.87961	0.31257

......Continued Table 5A.20

NT	1.312E-06	4.047E-06	0.00001082	0.00002379
	2.523E-07	5.856E-07	1.205E-06	2.023E-06
	5.2008	6.91029	8.97945	11.7587
HM	0.000E-32	6.873E-07	-3.258E-07	-2.081E-06
	0	9.038E-08	2.571E-07	5.107E-07
	--	7.6043	-1.26695	-4.07501
Total7	1.312E-06	4.383E-06	9.742E-06	0.00002204
	2.523E-07	5.948E-07	1.298E-06	2.400E-06
	5.2008	7.36808	7.50632	9.18342
P	0.00005099	0.00008978	0.00012128	0.00013808
	2.065E-06	4.149E-06	5.684E-06	6.520E-06
	24.68596	21.63785	21.33733	21.17728
W	0.000E-32	7.229E-07	1.229E-06	8.854E-07
	0	4.577E-07	7.877E-07	1.031E-06
	--	1.57927	1.56075	0.8589
PIM	0.000E-32	1.876E-07	5.727E-07	9.186E-07
	0	2.376E-08	8.201E-08	1.745E-07
	--	7.89847	6.98289	5.26377
PI	0.000E-32	8.537E-09	3.890E-08	7.877E-08
	0	1.446E-08	4.981E-08	1.020E-07
	--	0.59031	0.78098	0.77197
NCPROF	0.000E-32	5.437E-10	1.680E-07	7.674E-07
	0	7.554E-10	3.240E-08	1.113E-07
	--	0.71976	5.18665	6.89751
Total8	0.00005099	0.00009069	0.0001233	0.00014071
	2.065E-06	4.148E-06	5.753E-06	6.644E-06
	24.68596	21.86539	21.43269	21.1794
UNR	0.000E-32	1.248E-08	-4.397E-08	-3.154E-07
	0	1.169E-08	3.485E-08	8.309E-08
	--	1.06779	-1.26179	-3.79588
Total9	0.000E-32	1.248E-08	-4.397E-08	-3.154E-07
	0	1.169E-08	3.485E-08	8.309E-08
	--	1.06254	-1.26453	-3.79509

......Continued Table 5A.20

$\hat{\sigma}^2$	5.23E-05	9.51E-05	1.37E-04	1.72E-04
$[v\hat{a}r(\hat{\sigma}^2)]^{1/2}$	2.18E-06	4.39E-06	6.24E-06	7.65E-06
ζ_b	24.0	21.7	21.9	22.5

Quarters Ahead

Shocks	5	6	7	8
CD	1.283E-06	1.580E-06	1.733E-06	1.917E-06
	4.158E-07	5.878E-07	7.676E-07	9.811E-07
	3.08545	2.68736	2.25802	1.95405
CND	3.018E-07	1.348E-07	5.369E-07	4.916E-07
	5.449E-07	6.809E-07	7.873E-07	8.632E-07
	0.55384	0.19794	0.68188	0.56951
CSD	5.210E-07	4.027E-07	4.371E-07	4.777E-07
	2.386E-07	2.986E-07	3.495E-07	3.957E-07
	2.18378	1.34856	1.25065	1.20727
CS	2.621E-06	3.256E-06	3.699E-06	4.429E-06
	4.207E-07	5.313E-07	6.152E-07	7.137E-07
	6.23067	6.12978	6.01162	6.20592
Totall	4.729E-06	5.395E-06	6.425E-06	7.328E-06
	1.079E-06	1.369E-06	1.648E-06	1.948E-06
	4.38423	3.94066	3.89905	3.76087
BGFIR	3.663E-06	3.980E-06	4.826E-06	5.269E-06
	5.161E-07	5.598E-07	6.118E-07	7.017E-07
	7.09697	7.10852	7.88859	7.50946

......Continued Table 5A.20

BGFINR	1.546E-06	2.558E-06	4.163E-06	5.618E-06
	8.333E-07	9.998E-07	1.217E-06	1.378E-06
	1.85484	2.5585	3.42045	4.07613
BGFIME	3.897E-06	6.098E-06	8.361E-06	0.00001016
	1.004E-06	1.271E-06	1.506E-06	1.785E-06
	3.88235	4.79566	5.55358	5.69233
Total2	9.118E-06	0.00001266	0.00001739	0.00002104
	1.619E-06	1.962E-06	2.327E-06	2.696E-06
	5.63214	6.45072	7.47261	7.80264
INVNF	-2.213E-06	-2.691E-06	-4.399E-06	-5.662E-06
	1.414E-06	1.643E-06	1.721E-06	1.757E-06
	-1.56519	-1.63844	-2.55628	-3.22177
Total3	-2.416E-06	-2.897E-06	-4.487E-06	-5.837E-06
	1.431E-06	1.663E-06	1.753E-06	1.806E-06
	-1.68825	-1.74193	-2.5598	-3.23148
IM	5.054E-06	0.00001035	0.0000122	0.00001646
	2.188E-06	2.888E-06	3.666E-06	4.137E-06
	2.31012	3.58266	3.3281	3.9794
X	6.014E-06	7.054E-06	0.00001115	0.00001441
	2.376E-06	3.088E-06	3.758E-06	4.237E-06
	2.53054	2.28475	2.96616	3.40235
Total4	0.00001082	0.00001726	0.00002314	0.00003068
	2.378E-06	3.002E-06	3.612E-06	4.148E-06
	4.54897	5.74935	6.40499	7.39586
Total5	0.00002233	0.00003256	0.00004263	0.00005352
	2.601E-06	3.253E-06	3.887E-06	4.704E-06
	8.58403	10.01065	10.96616	11.37801
G	-1.553E-06	-1.798E-06	-1.798E-06	-2.357E-06
	4.797E-07	5.468E-07	6.565E-07	7.455E-07
	-3.23773	-3.28754	-2.73903	-3.16115
OG	-1.176E-08	4.645E-07	1.111E-06	1.613E-06
	2.545E-07	3.530E-07	4.661E-07	5.696E-07
	-0.0462	1.31581	2.38403	2.83208

......Continued Table 5A.20

Total6	-1.569E-06	-1.330E-06	-6.847E-07	-7.469E-07
	5.565E-07	6.785E-07	8.597E-07	9.869E-07
	-2.81896	-1.96053	-0.79645	-0.7568
ER	8.637E-06	0.00002517	0.00004001	0.00005984
	1.946E-06	3.052E-06	4.303E-06	5.577E-06
	4.43739	8.24569	9.29821	10.73107
NT	0.00003701	0.00005428	0.00007936	0.00009801
	2.812E-06	4.033E-06	5.509E-06	6.840E-06
	13.16489	13.45827	14.40428	14.32878
HM	-1.958E-06	4.566E-07	5.092E-06	0.00001009
	8.541E-07	1.327E-06	1.998E-06	2.544E-06
	-2.29193	0.34407	2.54837	3.96552
Total7	0.00004369	0.00007989	0.00012444	0.0001679
	3.709E-06	5.539E-06	7.980E-06	0.00001021
	11.77818	14.42245	15.59424	16.44606
P	0.000137	0.00013779	0.00013717	0.00013317
	7.006E-06	7.751E-06	8.263E-06	8.328E-06
	19.55458	17.77647	16.60027	15.98991
W	4.842E-07	7.376E-07	-1.136E-06	-1.998E-06
	1.265E-06	1.519E-06	1.785E-06	1.915E-06
	0.38273	0.48568	-0.63629	-1.0434
PIM	7.384E-07	-3.177E-07	-1.068E-06	-2.533E-06
	3.087E-07	5.002E-07	7.759E-07	1.109E-06
	2.39202	-0.6351	-1.37594	-2.28312
PI	2.762E-07	8.461E-07	1.322E-06	1.850E-06
	1.640E-07	2.505E-07	3.597E-07	4.876E-07
	1.68444	3.37846	3.67489	3.79496
NCPROF	1.933E-06	3.002E-06	4.777E-06	6.225E-06
	2.322E-07	3.986E-07	5.941E-07	7.861E-07
	8.32656	7.53193	8.04053	7.91933
Total8	0.00014038	0.00014202	0.00014101	0.00013665
	7.159E-06	8.009E-06	8.694E-06	8.811E-06
	19.6078	17.73239	16.21887	15.50969

......Continued Table 5A.20

UNR	-7.469E-07	-9.004E-07	-1.182E-06	-1.409E-06
	1.505E-07	2.397E-07	3.352E-07	4.200E-07
	-4.9618	-3.75599	-3.52699	-3.35524
Total9	-7.469E-07	-9.004E-07	-1.182E-06	-1.409E-06
	1.505E-07	2.397E-07	3.352E-07	4.200E-07
	-4.9618	-3.75599	-3.52699	-3.35524
$\hat{\sigma}^2$	2.04E-04	2.52E-04	3.06E-04	3.56E-04
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	9.41E-06	1.14E-05	1.40E-05	1.58E-05
ζ_b	21.7	22.2	21.9	22.5

TABLE 5A.21

Precision of The Stochastic Simulation Estimates For Rate of Inflation

METHOD 3 (Fair's Technique)

(see general notes, page 189)

Quarters Ahead

Shocks	1	2	3	4
CD	0.000E-32	-1.051E-08	8.843E-08	1.581E-07
	0	2.121E-08	9.318E-08	2.626E-07
	--	0.4957	0.94903	0.60215
CND	0.000E-32	-2.056E-07	-3.054E-07	3.423E-08
	0	1.336E-07	2.997E-07	4.264E-07
	--	-1.5393	-1.01928	0.08027
CSD	0.000E-32	5.757E-08	1.889E-07	3.855E-07
	0	5.673E-08	1.262E-07	1.788E-07
	--	1.01474	1.49648	2.15577
CS	0.000E-32	2.788E-07	8.294E-07	1.201E-06
	0	1.101E-07	2.606E-07	3.546E-07
	--	2.53308	3.18211	3.38584
Total1	0.000E-32	2.048E-07	1.091E-06	2.098E-06
	0	1.995E-07	4.943E-07	7.893E-07
	--	1.02667	2.20729	2.6579
BGFIR	0.000E-32	5.049E-07	1.885E-06	2.615E-06
	0	1.290E-07	3.133E-07	4.482E-07
	--	3.91474	6.01798	5.83513
BGFINR	0.000E-32	-9.169E-08	3.614E-07	8.720E-07
	0	1.767E-07	4.330E-07	6.405E-07
	--	0.51884	0.83472	1.36134
BGFIME	0.000E-32	6.358E-09	3.079E-07	9.468E-07
	0	1.991E-07	5.211E-07	7.879E-07
	--	0.03194	0.5909	1.20168

......Continued Table 5A.21

Total2	0.000E-32	8.370E-07	3.120E-06	5.940E-06
	0	3.990E-07	8.210E-07	1.203E-06
	--	2.12667	3.80729	4.5079
INVNF	0.000E-32	9.982E-07	1.341E-06	1.260E-06
	0	5.793E-07	1.019E-06	1.230E-06
	--	1.72318	1.31576	1.02459
Total3	0.000E-32	9.928E-07	1.259E-06	1.205E-06
	0	5.799E-07	1.034E-06	1.263E-06
	--	1.71193	1.21805	0.95396
IM	0.000E-32	-9.873E-07	-9.702E-07	1.412E-06
	0	5.644E-07	1.298E-06	1.849E-06
	--	-1.74915	-0.74729	0.76365
X	0.000E-32	-1.728E-07	8.777E-07	2.967E-07
	0	5.793E-07	1.330E-06	1.849E-06
	--	-0.29828	0.66009	0.16052
Total4	0.000E-32	-1.150E-06	-1.326E-07	1.674E-06
	0	5.797E-07	1.244E-06	1.821E-06
	--	-1.98311	-0.10661	0.91916
Total5	0.000E-32	4.836E-07	4.669E-06	9.282E-06
	0	4.286E-07	1.043E-06	1.672E-06
	--	1.12845	4.47554	5.55016
G	0.000E-32	-2.408E-07	-9.543E-07	-1.033E-06
	0	1.443E-07	2.897E-07	3.871E-07
	--	-1.66901	-3.29382	-2.66829
OG	0.000E-32	-5.370E-08	8.995E-08	1.881E-07
	0	5.000E-08	1.210E-07	1.883E-07
	--	-1.07403	0.74357	0.9986
Total6	0.000E-32	-2.957E-07	-8.624E-07	-8.466E-07
	0	1.646E-07	3.308E-07	4.507E-07
	--	-1.79653	-2.60705	-1.87818
ER	0.000E-32	-2.592E-07	-6.594E-07	1.584E-06
	0	6.296E-08	4.069E-07	1.020E-06
	--	-4.11685	-1.62042	1.5536

......Continued Table 5A.21

NT	1.626E-06	3.954E-06	9.123E-06	0.00001939
	2.540E-07	6.673E-07	1.356E-06	2.075E-06
	6.39911	5.92612	6.72637	9.34339
HM	0.000E-32	4.938E-07	-9.438E-08	-8.265E-07
	0	7.350E-08	2.079E-07	4.873E-07
	--	6.71906	-0.45396	-1.69619
Total7	1.626E-06	4.187E-06	8.374E-06	0.00002015
	2.540E-07	6.675E-07	1.398E-06	2.280E-06
	6.39911	6.27189	5.98911	8.83817
P	0.00004472	0.00008702	0.00012	0.00014422
	2.072E-06	3.982E-06	5.581E-06	7.146E-06
	21.58175	21.85508	21.49944	20.18037
W	0.000E-32	1.683E-06	1.787E-06	2.412E-06
	0	4.797E-07	7.960E-07	1.089E-06
	--	3.50778	2.24515	2.21499
PIM	0.000E-32	8.856E-08	3.151E-07	4.877E-07
	0	2.319E-08	8.862E-08	1.753E-07
	--	3.81847	3.55528	2.78259
PI	0.000E-32	4.074E-08	1.425E-07	2.842E-07
	0	1.545E-08	5.382E-08	1.028E-07
	--	2.6378	2.64713	2.76522
NCPROF	0.000E-32	8.361E-11	1.979E-08	1.899E-07
	0	1.048E-09	3.507E-08	1.186E-07
	--	0.07976	0.5643	1.60081
Total8	0.00004472	0.00008883	0.00012227	0.00014761
	2.072E-06	4.078E-06	5.674E-06	7.313E-06
	21.58175	21.78584	21.54963	20.18464
UNR	0.000E-32	2.950E-08	-6.929E-08	-2.350E-07
	0	1.075E-08	3.337E-08	9.094E-08
	--	2.7425	-2.07602	-2.5846
Total9	0.000E-32	2.950E-08	-6.929E-08	-2.350E-07
	0	1.075E-08	3.337E-08	9.094E-08
	--	2.7425	-2.07602	-2.5846

......Continued Table 5A.21

$\hat{\sigma}^2$	4.6E-05	9.3E-05	1.3E-04	1.8E-04
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	2.1E-06	4.2E-06	6.1E-06	8.2E-06
ζ_b	21.9	22.3	21.9	21.5

	Quarters Ahead 5	6	7	8
Shocks				
CD	6.510E-07	9.828E-07	1.819E-06	1.927E-06
	4.020E-07	5.697E-07	7.320E-07	9.373E-07
	1.61947	1.72516	2.4847	2.05605
CND	4.227E-07	8.964E-07	6.704E-07	1.691E-06
	5.406E-07	6.532E-07	7.588E-07	8.322E-07
	0.78179	1.37222	0.88351	2.03239
CSD	5.865E-07	5.516E-07	8.726E-07	8.377E-07
	2.218E-07	2.742E-07	3.335E-07	3.691E-07
	2.64369	2.01197	2.6164	2.26937
CS	2.192E-06	2.476E-06	3.235E-06	3.446E-06
	4.469E-07	5.488E-07	6.361E-07	7.207E-07
	4.90532	4.51094	5.08626	4.78206
Totall	4.104E-06	5.043E-06	6.569E-06	7.670E-06
	1.073E-06	1.381E-06	1.668E-06	1.913E-06
	3.82482	3.65069	3.93788	4.01015
BGFIR	3.576E-06	4.632E-06	5.222E-06	5.601E-06
	5.396E-07	6.032E-07	6.581E-07	7.356E-07
	6.62702	7.679	7.93543	7.61444

......Continued Table 5A.21

BGFINR	2.313E-06	3.075E-06	3.585E-06	2.062E-06
	8.450E-07	1.020E-06	1.219E-06	1.408E-06
	2.73707	3.01622	2.94091	1.46508
BGFIME	2.573E-06	3.291E-06	3.845E-06	4.252E-06
	1.034E-06	1.284E-06	1.508E-06	1.779E-06
	2.4872	2.56248	2.54974	2.39031
Total2	8.820E-06	1.220E-05	1.650E-05	2.010E-05
	1.500E-06	1.940E-06	2.260E-06	2.913E-06
	5.62482	6.31081	7.27161	6.90214
INVNF	-1.702E-06	-3.393E-06	-2.455E-06	-6.923E-06
	1.431E-06	1.625E-06	1.786E-06	1.979E-06
	-1.18974	-2.08792	-1.37437	-3.49866
Total3	-1.644E-06	-3.548E-06	-2.756E-06	-7.480E-06
	1.465E-06	1.671E-06	1.824E-06	2.033E-06
	-1.12226	-2.12393	-1.51119	-3.67831
IM	2.239E-06	5.161E-06	7.170E-06	0.0000128
	2.444E-06	3.200E-06	3.935E-06	4.543E-06
	0.91612	1.6128	1.82225	2.81829
X	4.451E-06	7.586E-06	0.00001034	0.00001694
	2.430E-06	2.983E-06	3.527E-06	4.266E-06
	1.83171	2.54353	2.93099	3.97161
Total4	6.723E-06	0.00001276	0.00001756	0.00003
	2.433E-06	3.227E-06	3.839E-06	4.571E-06
	2.76314	3.95422	4.57527	6.56349
Total5	0.00001749	0.00002518	0.00003422	0.00004259
	2.444E-06	3.326E-06	3.982E-06	4.769E-06
	7.15502	7.56828	8.59341	8.93105
G	-1.396E-06	-1.991E-06	-2.447E-06	-2.452E-06
	4.461E-07	5.081E-07	6.392E-07	7.137E-07
	-3.12958	-3.91855	-3.82747	-3.43508
OG	8.096E-08	4.423E-09	-4.587E-08	2.918E-08
	2.710E-07	3.423E-07	4.254E-07	5.483E-07
	0.29874	0.01292	-0.10781	0.05321

......Continued Table 5A.21

Total6	-1.320E-06	-1.984E-06	-2.489E-06	-2.424E-06
	5.544E-07	6.495E-07	7.924E-07	9.435E-07
	-2.38054	-3.05532	-3.14155	-2.56906
ER	7.619E-06	0.00001775	0.00003243	0.00004928
	1.867E-06	2.878E-06	3.979E-06	5.232E-06
	4.08015	6.16891	8.1501	9.41808
NT	0.00003609	0.00005302	0.00007795	0.00009978
	2.963E-06	3.927E-06	5.384E-06	6.965E-06
	12.18006	13.50215	14.47806	14.32649
HM	-1.396E-06	-9.118E-08	2.909E-06	8.993E-06
	8.657E-07	1.328E-06	1.893E-06	2.422E-06
	-1.61278	-0.06867	1.53661	3.7133
Total7	0.00004232	0.00007069	0.00011331	0.00015806
	3.592E-06	5.010E-06	7.082E-06	9.446E-06
	11.78199	14.1108	15.99916	16.73335
P	0.00014528	0.00014602	0.00014139	0.00013732
	7.548E-06	7.977E-06	8.492E-06	8.768E-06
	19.24767	18.30492	16.64931	15.66248
W	2.574E-06	3.165E-06	2.398E-06	3.294E-06
	1.332E-06	1.514E-06	1.696E-06	1.764E-06
	1.93158	2.09062	1.41376	1.86747
PIM	3.334E-07	-1.499E-09	-2.965E-07	-2.087E-06
	3.092E-07	4.907E-07	7.322E-07	1.043E-06
	1.07808	-0.00305	-0.40497	-2.00184
PI	3.962E-07	4.847E-07	6.019E-07	1.079E-06
	1.655E-07	2.466E-07	3.358E-07	4.470E-07
	2.39406	1.96567	1.79258	2.4136
NCPROF	8.300E-07	1.823E-06	3.956E-06	6.111E-06
	2.497E-07	4.242E-07	6.188E-07	8.285E-07
	3.32464	4.29708	6.39356	7.37534
Total8	0.00014943	0.0001515	0.000148	0.00014563
	7.814E-06	8.252E-06	8.728E-06	9.286E-06
	19.12275	18.35923	16.95659	15.68265

......Continued Table 5A.21

UNR	-5.696E-07	-9.022E-07	-1.325E-06	-1.640E-06
	1.565E-07	2.413E-07	3.341E-07	4.150E-07
	-3.63898	-3.73859	-3.96459	-3.9528
Total9	-5.696E-07	-9.022E-07	-1.325E-06	-1.640E-06
	1.565E-07	2.413E-07	3.341E-07	4.150E-07
	-3.63898	-3.73859	-3.96459	-3.9528
$\hat{\sigma}^2$	2.1E-04	2.4E-04	2.9E-04	3.4E-04
$[\hat{var}(\hat{\sigma}^2)]^{1/2}$	9.1E-06	1.0E-05	1.3E-05	1.5E-05
ζ_b	22.8	23.6	23.0	22.6

Chapter 6

CONCLUSIONS

This chapter offers a review of the major results of the study, a comparison with some other Canadian studies, and some possibilities for further research.

The contribution of various sources of variability in Canadian Gross Domestic Product (GDP), the rate of change in the GDP deflator (PDOT), and the rate of unemployment (UNR) have been estimated, using a Canadian quarterly macroeconometric model developed specifically for this purpose. The model consists of 71 equations: 22 behavioral and 49 identities. We estimated our model mainly by two stage least squares using 16 principal components as instruments, over a sample period of 1962:4 to 1988:4. Dynamic and static simulations were carried out to check the model's ability to replicate historical time series. The results from historical simulation show that the performance of the model is satisfactory.

In order to take into account shocks associated with exogenous variables, we have followed Fair and added autoregressive equations for eight important exogenous variables. The final model, then, consists of 79 equations with 30 stochastic equations and 49 identities. We chose the eight quarters from 1985:1 to 1986:4, for the variance decomposition exercise, primarily because this period did not contain either a boom or a recession.

The variance decomposition exercise for three endogenous variables, GDP, PDOT and UNR, was undertaken using three methods (METHOD 1, METHOD 2 & METHOD 3, as described in chapter 2) based on stochastic simulation using both the distribution-based Fair's technique and distribution-free bootstrapping technique. However, we decided to use only the METHOD 3, based on both stochastic simulation procedures, for the final interpretation of our results. It is important to emphasize that what is being estimated is the contribution of the error terms in the equations to the total variances of GDP, PDOT and UNR. It should be noted that this contribution is different from the conventional multiplier effects of change in exogenous variables.

6.1. Main Results of the Study

6.1.1. Real GDP

The results obtained from METHOD 3, based on both simulation procedures show that, among the five major shocks, the total contribution of shocks to the private expenditure components of real GDP (or total demand shocks), in its effect on aggregate real GDP, is the largest. The contributions of the other four major shocks; total price and income, total public sector, total financial sector, total unemployment and labour force, are turn out to be rather small. The shocks to the total private expenditure components of real GDP, on average over the simulation period, account for 88 percent of the variance of real GDP, according to Fair's technique. Among its components, imports and exports turn out to matter the most, accounting for 56.8 percent of the group contribution. Among other components of this group, total consumption shocks account for 23.6 percent, total investment for 25.6 percent, and inventory investment for only -4.9 percent of the group contribution.

Total price and income shocks, though the second largest contributor, account for only 5.1 percent of the variance of real GDP, on average. Shocks to corporate profits dominate this group, accounting 92 percent of the group contribution, while the combined contribution of the GDP price deflator, nominal wages and the price index for imports, which could be considered as supply shocks, account for 17 percent of the group's contribution.

Total public sector shocks, total financial sector shocks, and total unemployment and labour force shocks, on the other hand, contribute respectively, on average, only 2.6 percent, 1.3 percent and 1.3 percent. Similar results are obtained from bootstrapping.

Although, the top group contributors to the variance of real GDP are similar according to both bootstrapping and Fair's technique, with the exception of the shocks to the export equation (which invariably make the largest contribution), the top individual contributors vary both across the simulation period and across the two simulation procedures (see table 5.16). Considering first bootstrapping, for the first of the eight quarters, for example, the top five contributors are: i) consumer expenditures on services (9.6 percent), ii) business fixed investment in machinery and equipment (8.6 percent), iii) consumer expenditures on nondurables (8.3 percent), iv) total imports (6.1 percent), and v) consumer expenditures on semi-durables (5.3 percent). For the same quarter, the top five contributors according to Fair's technique are: i) total imports (16.8 percent), ii) consumer expenditures on services (7.4 percent), iii) non-residential business fixed investment (6.5 percent), iv) consumer expenditures on semi-durables (4.8 percent), and v) business fixed investment in machinery and equipment (4.3 percent). For the eighth quarter, the top five contributors according to Fair's technique are: i) business fixed investment in machinery and equipment (11.9 percent), ii) consumer expenditures on durables (10.2 percent), iii) corporate profits (8.0 percent), iv) non-residential business fixed investment (6.9 percent) and v) imports (5.8 percent). For the same quarter, the top five contributors according to bootstrapping are: i) business fixed investment in machinery and equipment (11.3 percent), ii) imports (10.3 percent), iii) consumer expenditures on durables (9.9 percent), iv) corporate profits (8.1 percent) and v) non-residential business fixed investment (5.6 percent).

6.1.2. Rate of Change in the GDP Price Deflator (PDOT)

In the case of PDOT, there are only a few sources that matter much. Unlike the real GDP case, the top contributors to the variance of PDOT are the same across both simulation periods and simulation procedures. The actual sizes of their contributions, however, vary from quarter to quarter (see table 5.17). Since all the explanatory variables in the PDOT equation are predetermined except the domestic rate of interest (NINT), it turned out that in the first quarter, the rate of interest equation shock and the PDOT equation shock itself account for all of the variation. Although the shock to the PDOT equation is dominant over the eight quarters, the domestic and U.S. rate of interest shock (NT), the exchange rate shock, and the total private expenditure components of GDP (or total demand) shock are also important, especially over the last four quarters of the simulation period. The contribution of the domestic and U.S. rate of interest shock increases from 4.3 percent (bootstrap) and 4.2 percent (Fair's technique) in the second quarter, to 27.5 and 29.2 percent in the eighth quarter. The exchange rate contribution rises from -0.4 and -0.3 percent in the first quarter to 16.8 and 14.4 percent in the eighth quarter. The contribution of the total private expenditure component of GDP shock increase from 0.4 and 0.5 percent in the first quarter to 15 and 12.3 percent in the eighth quarter. While shocks to all the components of private expenditure contribute, the shocks to imports and exports make the largest contribution.

As we have noted above, the price equation shock is the largest contributor for all quarters. Its relative contribution, however, decreases significantly from 94.5 and 93.3 percent in the second quarter to 37.5 and 40.1 percent in the eighth quarter.

6.1.3. The Rate of Unemployment (UNR)

Like the case of PDOT, there are only a few sources that matter much here. The top contributors to the variance of UNR are also same across simulation periods and simulation procedures. Their relative contributions, however, do vary across the eight quarter (see table 5.18). Since all the explanatory variables are predetermined in the UNR equation, the shock to the UNR equation itself accounts for all of its variation in the first quarter. Although the shock to the UNR equation itself is dominant over the eight quarter period, the total private expenditure components of GDP (or total demand) shocks are also important, especially over the last four quarters. This total contribution increases from 4.2 percent (Fair's technique) and 5.9 percent (bootstrapping) in the second quarter to 34 percent (Fair's technique) and 33 percent (bootstrapping) in the last quarter. The contribution of total consumption goes from 1.1 and 1.9 percent to 10.6 and 11.7 percent, of total investment from 3.8 and 3.9 percent to 12.6 and 14.2 percent, and of total imports and exports from 0.2 and 1.3 percent to 14.5 and 14.7 percent.

In contrast to the case of PDOT, the relative contribution of the UNR equation shock, though dominant over all eight quarters, decreases from 96.9 (Fair's technique) and 95.3 percent (bootstrapping) to 65.0 and 65.6 percent. On the other hand, the relative contribution of final expenditure shocks, including exports, business fixed investment in machinery and equipment, and imports increases significantly. These results also seem to suggest that sources which are not major contributors in the short run may account for more of the variation in UNR in the long run. Finally it should be noted that shocks to the labour supply equation (NS) contribute little to the variation of UNR. However, the reader should be reminded that this does not imply that deterministic movements in NS have no influence on UNR.

To summarize, the results show that the contributions from the various sources vary across the length of the simulation period. Since our simulations are limited to only eight quarters, it is impossible to determine whether or not the relative contributions would stabilize over a longer simulation period. The analysis for PDOT and UNR does seems to suggest, however, that the source which is dominant in the short run may be less important in the long run. These results also suggest that shocks to real expenditure components contribute substantially to the variances of both GDP and UNR, while shocks to financial variables contribute substantially to variations in PDOT.

6.2. Comparison With the Results of Other Studies

In order to compare our results, we will consider both other Canadian studies and Fair's U.S. study. We consider Fair's results because his analysis is based on what we have described as METHOD 1, so that differences may be attributed to differences in methodology.

We will consider Canadian studies based on both i) the VAR methodology, both standard and structural, and ii) the index model. All Canadian VAR studies focus on Canadian-U.S. macroeconomic interaction and consider only Canadian output and prices in their variance decomposition exercises. The single index model study, on the other hand, analyses only the fluctuations in Canadian employment growth.

All the Canadian VAR studies suggest strong relationships between Canadian and U.S. variables, especially monetary ones, and conclude that U.S. economic activity strongly influences the Canadian economy. In a nine variable model based on monthly data from 1971 to 1983, Burbidge and Harrison (1985), though not undertaking a variance decomposition exercise, suggest that Canadian variables are significantly influenced by most major U.S. variables. While the U.S. interest rate is the most important variable for the determination of Canadian economic activity, the Canadian price level, however, is the only variable in their analysis that seems to be uninfluenced by U.S. variables.

Kuszczak and Murray (1987) acquired similar results by comparing closed and open-economy models estimated as a VAR system. In their variance decomposition analysis, more than 50 percent of the forecast variance of each Canadian variable was explained by U.S. variables.

While the VAR studies cited thus far are based on the standard VAR methodology, Johnson and Schembri (1989) based their study on both the standard and structural VAR methodologies. Their variance decomposition analysis indicates that U.S. variables (output and prices) dominate the fluctuations in Canadian output but are less important for fluctuations in Canadian prices. Most of the variation in the Canadian price level is accounted for by its own shock.

The results obtained by Racette and Raynauld (1992), using the structural VAR technique, differ from those of other VAR studies, as far as the variation in Canadian inflation is concerned. Their analysis propose that the U.S. prices play a much stronger role than Canadian monetary aggregates in the determination of Canadian inflation. Although Nadeem (1992) has found that the results are sensitive to alternative specifications of the VAR models (standard and structural), the U.S. variables do seem to contribute significantly to the variation of Canadian output and prices.

The above mentioned VAR studies give different results concerning the importance of U.S. variables in explaining the variation in Canadian prices. Burbidge and Harrison (1985) and Johnson and Schembri (1989) find that the dominant source of fluctuation in Canadian inflation is its own shock. On the other hand, Kuszczak and Murray (1987), Racette and Raynauld ((1992), and Nadeem (1992) find that U.S. variables contribute substantially to variation in Canadian Prices. Our results show that, in first four quarters, the dominant source of fluctuation in Canadian inflation is its own shock, but that other variables, including the U.S. rate of interest and the exchange rate, become important after four quarters.

In the case of Canadian output, the VAR studies generally find that both Canadian and U.S. variables are important. Some studies suggest that the U.S. variables are dominant, explaining more than 50 percent of the variation in Canadian output. Our analysis of the variation of Canadian output indicates that the total contribution of shocks to the private expenditure components of real GDP is the largest with export and import shocks dominating. Although we have not modelled the impact of U.S. variables on exports and imports explicitly, the significance of export and import shocks does indicate the importance of U.S. variables in the variation of Canadian output.

Altonji and Ham (1990), using the index model, found U.S. shocks to be the dominant source of variation in Canadian unemployment growth, accounting for about seventy percent of the variation. Our results, however, do not show the same importance of U.S. shocks in the variation of the rate of unemployment. In particular the contribution of export and import shocks rises from about 7 percent in the second quarter to over 20 percent in the last quarter. This result does indicate some importance for U.S. variables, since we can think of Canadian exports and imports as being affected by U.S. variables.

Fair (1988) has undertaken a variance decomposition exercise for U.S. GNP and the

U.S. GNP deflator over a period of eight quarters based on what we have described as METHOD 1. First Considering real GNP, he also found that there were many important sources of variation and that their contributions varied across the forecast period. The contribution of total demand shocks was the largest accounting for more than 70 percent of total variation over the forecast period. Among the demand shocks, the export equation shock, though not the largest, contributed significantly, especially over the last four quarters. Shocks to inventory investment, imports, consumption of durables and consumption of services were among the other top contributors. These results are comparable to ours.

Fair's results vary from ours, however, when the variance of the GNP deflator is explored. In Fair's results the shock to the price equation itself is largest in the first four quarters, but the shock to the import price equation becomes more important in last four quarters. In our results, the shock to the price equation itself is the largest contributor over all eight quarters and the domestic and U.S. rate of interest equation shocks become more important over last four quarters. In our results, the shock to the import price equation is never a significant contributor to the variance of PDOT.

In brief, there are major similarities between Fair's results and our own, but there are also significant differences, especially for the source of variation in the price variables.

6.3. Suggestion For Future Research

We conclude with a few suggestions for possible improvements to the research reported in this thesis. First, since the interpretation of all the results reported is based on the chosen macroeconometric model, we consider our results to be valid only in the context of that model. As VAR results are found to be sensitive to alternative specifications, we think it could be interesting to undertake such a sensitivity analysis in our framework.

Second, we have estimated the contribution of various sources of variability in real GDP, PDOT, and UNR for only eight quarters. It would be interesting to extend this period to another 10 or 15 quarters to see if these contributions stabilize over a longer period. Our analysis suggests that sources that are not important in the short run may become important in the medium or long run, and vice versa.

Third, the assumption that the variance-covariance (VCV) matrix is block diagonal (no correlation between errors in the block of behavioral equations and errors in the block of autoregressive equations for the exogenous variables) was shown to be crucial. This raises a concern about the exogeneity of variables that were assumed to be exogenous in the model. Another possible improvement would be to undertake exogeneity tests and modify the model accordingly.

Finally, it would be interesting to apply METHOD 2 and METHOD 3, along with bootstrapping, to Fair's econometric model of the U.S. economy with U.S. data to see whether his results are sensitive to the use of these other methods.

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