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## Population and Development Planning (PDP) Model: The 1998 Update

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Philippine Institute for Development Studies

## Population and Development Planning (PDP) Model: The 1998 Update

*Aniceto C. Orbeta, Jr., Edith Laviña  
and Mildred Belizario*

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# **Population and Development Planning (PDP) Model: The 1998 Update**

*Aniceto C. Orbeta, Jr.,  
Edith Lavina  
and  
Mildred Belizario*

## **Abstract**

This paper presents an update of the Population and Development Planning (PDP) model. The PDP model is an economic-demographic model designed to capture the long-term interactions between economic and demographic variables. Also presented in the paper are results of diagnostic and policy simulation runs.

Keywords: Econometric Modeling; Demographic Economics, General; Philippines  
JEL: C50, J10

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# Population and Development Planning (PDP) Model: The 1998 Update\*

*Aniceto C. Orbeta, Jr., Edith Lavina and Mildred Belizario<sup>1</sup>*

## I. Introduction

The interaction of economic and demographic variables in the course of development has long been recognized in the literature. Modeling these interactions has continued to challenge analysts to this day. Over the years, the modeling of these interactions has evolved from conceptual to quantitative. The quantitative models range from single equation to multi-equation systems and the multi-equation models include macro-econometric and general equilibrium types. These models have also come in varying degrees of disaggregation as well as in varying levels of coverage of the interactions between economic and demographic variables<sup>2</sup>. These models have been useful tools for long-term economic planning.

The Population and Development Planning (PDP) model is a member of macro-econometric class of models. The history of the economic-demographic modeling in the country is relatively long. To date, there are at least four strands of economic-demographic models that have been developed for the country, namely: Ruprecht (1967); Encarnacion et al. (1974); the Bachue-Philippines model of Rodgers et al (1978); and the PDP model<sup>3</sup>. The PDP model itself has undergone several revisions. The model design philosophy, for instance, has shifted from developing highly disaggregated model that can deal with several development issues simultaneously into developing a smaller core economic-demographic model which can be readily expanded, through sub-models, to deal with different development issues. This was thought of as a natural compromise between the ease of model management and data requirements and model usefulness. The core model includes only major simultaneous interactions between socio-economic processes and outcomes and demographic processes and outcomes. Specialized issues are dealt with through sub-models. For instance, a sub-model that deals with income distribution

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<sup>2</sup> There were attempts at adding environmental variables in these interactions. One of the early attempts is the research program under the Population, Resources, Environment and the Philippine Future (PREPF). Orbeta (1996) provides a selective review of these attempts. However, to the best of knowledge of the authors no running model is existing to date that explicitly considers economic, demographic and environment variables.

<sup>3</sup> See Orbeta (1996) for a description of the features of the other models.

questions was developed in Paqueo, Herrin and Associates (1984). A women sub-model to deal with gender issues was also presented in Orbeta and Sanchez (1995). This particular study updates the core model.

The version of the PDP model that was used in this study is described in Orbeta (1992). It consists of two major sub-models, namely, the economic sub-model and the demographic sub-model. The economic sub-model is further composed of the following components: the income determination block; the labor employment block; the consumption, investment and capital accumulation block; the price block; the government finance block; demand for land; structural change block; the financial sector block; and the external sector block. The demographic sub-model is basically an abridged life table driven by infant mortality rate. The age-specific (female) population was computed using survivorship functions implied by the life table. Fertility is determined by age-specific fertility equations. Currently, no treatment for international migration has been developed for the model. Since the model uses national data, internal migration is also not considered.

## **II. The Data**

The data used for the updating the PDP model were obtained from three sources, namely: (a) statistical publications of agencies; (b) special tabulations from agencies and other institutions; and (c) data calculations from previous studies.

### ***Statistical Publications of Agencies***

Data were taken from the published statistics of several agencies. These publications include: National Income Accounts (NIA) and Philippine Statistical Yearbook (PSY) of the National Statistical Coordination Board (NSCB); Selected Philippine Economic Indicators of the Bangko Sentral ng Pilipinas (BSP); Current Labor Statistics and Yearbook of Labor Statistics of the Bureau of Labor Statistics (BLES); and International Financial Statistics (IFS) of the International Monetary Fund (IMF).

### ***Special Tabulations from Agencies and Other Institutions***

Data for public education and health expenditures were lifted from the Budget of Expenditures and Sources of Financing (BESF) of the Department of Budget and Management (DBM). These were for the years 1986 to 1997. Current operating expenditures and capital outlays of government agencies which can be classified under education and health were add up to come up with the data on current operating expenditures in education (CEDG), current operating expenditures in health (CHG), government capital outlay in education (INEDG) and government capital expenditure on health (INHG).

### ***Data Calculations from Previous Studies***

For some variables, data were calculated based on the methodologies of previous studies. These variables include the gross private investment on fixed capital formation (INVFP), initial capital stock, private sector inventory stock (INVFY),

government & private capital stock (KG and KP), adjusted infant mortality rates (INFANM) and the proportion of population 25 years old and over who are college graduates (PEC25).

The collection of the wage rate of unskilled workers was terminated in 1981, thus, for 1981 onwards, the growth rate of the legislated wage of non-agricultural was applied to the 1980 data to obtain a consistent series for the wage of unskilled workers (see note 5).

Annex A shows a table containing detailed description of the variables used in the model.

### III. The Model

#### A. *Economic Submodel*

##### 1. Income determination block

In the model, output is determined through a production function that assumes that GNP is determined by the two factors of production: capital and labor. Capital stock is the totality of privately- and public-originated capital stock. Labor is augmented by two human capital variables, which are the proportion of college graduates among 25 years old and over, and per capita health expenditures. Labor is augmented as follows:

$$L = L_0 * E^A * H^{(1-A)}$$

where:

E = proportion of college graduates among 25 years old and over

H = health expenditures per capita.

This was formulated with the view that the elasticities of output with respect to the two human capital variables are not equal. The parameter A was obtained by assigning several values of A (from 0 to 1) in grids of .01 in the estimation of the GNP equation. The one that generated the smallest root-mean-square percentage error (RMSPE) for the GNP equation in the simulation was chosen. The one that generated the smallest RMSPE is for A=0.8<sup>4</sup>.

##### 2. Labor and Employment

An important component in modeling economic-demographic interactions is the modeling the demographic pressure on the labor market. To capture demographic pressure on the labor market, the model postulates that wage rates respond to labor market situations. Survey wages were found to respond only with a lag. Therefore, it seems that equilibrium in the labor market is not instantaneous and current adjustment

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<sup>4</sup> In previous versions of this model, direct estimation of the parameters of the GNP equation was also done, but the RMSPE generated from that specification is larger.

in wages is only partial. This is contrary to the usual assumption for less developed countries attributed to by Lewis (1954) and Ranis and Fei (1961) that labor supply is infinitely elastic.

*a. Wage Rates*

The wage variables used are the legislated wage rates for both the agricultural and non-agricultural workers (WLAGRI and WLNA), wage of unskilled<sup>5</sup> workers in Metro Manila (WUSN) and nominal survey wage for agricultural workers (WAGN). A weighted legislated wage rate was introduced because it generated the expected signs in many of its uses, such as the general price equation. This is computed as

$$WWAGN = WLAGRI * (EMG/EMP) + WLNA * ((EMP-EMG)/EMP).$$

Previous results (Paqueo, Herrin, and Associates, 1984) showed that real wage rates do not respond well to labor market conditions, thus, the nominal counterpart were used. Current results show that nominal survey wage variables responded significantly, although with a lag, to the tightness in the labor market. These survey wages, in turn, are made to explain the variations in the legislated wage rates. The hypothesis is that the government is using these survey wages as inputs in determining the legislated wage rates.

*b. Employment*

The equation for total employment was specified with the assumption that the variations in underemployment are not independent from the variations of the “full-time” underemployment. Given this assumption, the “full-time” labor input is the determinant of total employment.

For the agriculture sector, the gross value added of the sector and the real wage for agriculture determine the sector’s employment. This implies that employment in agriculture is output-determined.

*c. Labor Force Participation and Labor Supply*

The labor force participation rate for men does not vary much. This is therefore considered exogenous. Women’s labor force participation, on the other hand, is assumed to be determined by real wage rate, education status of the population<sup>6</sup>, capital stock per capita and fertility rate.

Labor supply is determined by multiplying the labor force participation rate to the working age population (15 years old and over).

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<sup>5</sup> The series (1967-1980) was obtained from the Central Bank Statistical Bulletin. This was discontinued in 1980. To extend the series, the growth rate of the legislated wage rate for non-agricultural workers (WAGEL) was applied to the 1980 value.

<sup>6</sup> A more appropriate variable is the education status of the women. This variable is not yet updated so for this version of the model this variable is proxied by the education status of the population.



### 3. Consumption, Investment and Capital Accumulation

#### a. *Private Consumption*

Aggregate private consumption equation used per capita consumption as the dependent variable with the following variables as regressors: net disposable income, youth dependency ratio and real interest rate. Consumption is further disaggregated into expenditure groups, to wit, education, health, food and others. A system of demand equation for the different expenditure groups was estimated using the Workings (1943) model. The following is the estimable form of the model:

$$\mu_i = a_i + b_i \log\left(\frac{X}{kP}\right)$$

where  $\mu_i$  is the share of good  $i$  to total expenditures;  $X$  is the total expenditure; and  $P$  is the general price. Deaton and Muellbauer (1980a) described  $k$  as a deflator that reflects, among others, changes in the composition of households. Thus,  $X/kP$  is called the “needs-corrected” total expenditure, which is the parameter that will be used to introduce demographic variables into the structure of the demand system. Since rapid population growth leads to higher youth dependency ratio, the system predicts that rapid population growth translates to lower needs-corrected total expenditure outlay.

The system of demand equation was estimated by seemingly-unrelated regression (SUR) procedure. In the equations,  $k$  is implemented by using a standardized youth dependency ratio. The youth dependency ratio was standardized to its 1970 value.

#### b. *Private Investment*

GNP lagged one period and real price of investment goods are the determinants of private investment. GNP is a proxy for investment opportunities, e.g., market size.

#### c. *Government Consumption and Investment*

In specifying the government consumption expenditure equation, it is hypothesized that higher revenues and higher population size lead to an increase in government consumption.

Government investment is disaggregated into non-education and education components. Each component is computed as a fixed ratio of GNP.

*d. Capital Accumulation*

Capital stock is accumulated in the model by adding to the previous year's depreciated capital stock the current year's capital expenditures. Two kinds of capital stock were generated in this model: the privately- and the government-originated capital stock.

The depreciation rate for the current period is obtained by getting the ratio of capital consumption allowance and the sum of the two capital stocks, both lagged one period. Current capital consumption allowance (KCAR) is determined by the current and the previous year's total capital stock.

*e. Inventory Investments*

The ratio of inventory stock (INVPY) to GNP is used in the model to explain the level of inventory investments (IINV). The rationale behind this formulation is that there is a desired level of inventory stock given income and this is captured by the said ratio.

An initial inventory stock was computed as the product of private-originated stock (KP) and the ratio of changes in stock to private investment to fixed capital formation. Inventory stock is then obtained by accumulating the yearly change in inventory levels.

#### **4. Prices**

*a. General Price Index*

In the model, the GNP deflator or the indicator of the general price level (PGNP) is determined by the ratio of money supply to nominal GNP, the weighted average legislated wage rate and the import price index (DPM).

*b. Consumer Price Index*

The equation of the consumer price index (CPI) has the GNP deflator as the explanatory variable. This signifies that the movement of the consumer price index follows that of the movement of the general price index.

*c. Real Price of Investment Goods*

The real price of investment goods is represented by the ratio of GDCF deflator to the GNP deflator. The explanatory variables include the following: real cost of money which is represented by the ratio of t-bill rate (TBILL) and GNP deflator, the average tax rate (TAXRR), and the real import price index. It is expected that all three variables are positively correlated with the real price of investment.

*d. Price of Imported Goods*

Previous version of the model used the domestic price of imported goods (implicit price index of imports from the National Income Accounts). However, when used in the regression where the explanatory variables are real GNP and level of imports, it did not yield the correct signs. Hence, the trade import price index from NSO was used.

## **5. Government Expenditure and Finance**

Government expenditures and revenues are expected to be related to the output of the economy. Thus, most government revenue and expenditure variables, except for consumption expenditure discussed earlier, are related to GNP via the corresponding ratios that are assumed to be policy - determined. The breakdown of the accounts is determined solely by the demands of the specifications of the other parts of the model, such as the expenditures on health and education. The breakdown can be expanded or reduced depending on a particular policy exercise without disrupting so much the other relationships in the model.

## **6. Demand for Land**

The demand for land is determined by the real wage in agriculture, value added in agriculture and total population. It is expected that demand for land will expand with higher value added in agriculture while it is expected to decrease with increases in real wages in agriculture. Further, increasing population will reduce lands available for cultivation since more land for human settlements will be required.

## **7. Structural Change**

Structural change is captured in the model via changes in the shares of agriculture and industry in the output. The share of services will be computed as a residual.

*a. Share of Agriculture*

The share of agriculture to total output is estimated as a function of GNP per capita (GNP/POP), the real wage in agriculture and a land scarcity indicator - the ratio of land under cultivation to gross value-added in agriculture (LAND/VAR).

It is expected that since agriculture is relatively more land-intensive, the output from agriculture will decline as the economy grows, assuming of course, that the land-use intensity does not vary very much. This is mainly due to the resulting scarcity of land. On the demand side, as income increases, the typical consumption basket will contain relatively lesser agricultural products. These twin hypotheses are borne out by the estimated equation.

*b. Share of Industry*

Likewise, the share of industry in total output is determined by income per capita (GNP/POP) and the real wage rate of unskilled workers (WUSN/CPI).

The equations imply that structural changes in output are both supply-and demand-driven. On the one hand, as per capita income increases, less and less output from agriculture while more and more of industrial output will be demanded. Both of the shares will diminish with increases in sectoral wages. In addition, for the share of agriculture, as land becomes scarce the proportion of output from agriculture also declines.

This set of equation was estimated using SURE to allow for corrections due to the correlation of the error terms.

## **8. Financial Sector**

*a. Money Supply Determination*

A substantial overhauling of the financial sector was done for this version of the model. In previous versions, money supply (MS) is assumed to be determined by the Central Bank's balance sheet. Two items in this balance sheet, the net domestic assets (NDA) and net foreign assets (NFA), are related to excess demand variables. The sum of these two stock variables, the base money, is the determinant of the narrow money (M1) supply. There are two excess demand variables in the model. These are the government deficit (GDEF) and current account deficit<sup>7</sup> (CURBAL). GDEF was made the determinant of NDA while CURBAL was made the determinant of NFA.

These specifications cannot handle recent movements of both NFA and NDA. It generated unexpected values for the monetary base in long term simulations. The interim solution introduced in this version of the model is to link the growth in money base to real output. The implication of this specification is that money supply no longer grows in response to macroeconomic imbalances. Consequently, prices are no longer affected by the imbalances.

*b. Interest Rate*

The model assumes equilibrium in the financial market and postulates that interest rate (90-days TBILL rate) moves to equate money demand and supply. The interest rate equation is an inverted real money demand given money supply and output.

The direct implication of this assumption can be seen in the model for private investment. Imbalances in money supply and demand will drive interest rate movements and, in turn, private investment expenditures.

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<sup>7</sup> The more appropriate variable would be the overall Balance of Payments (BOP). This was avoided because this would require modeling the capital account of the BOP.

## 9. External Sector

### a. Exports

Export is determined by output (GNP), a price variable (ER\*DEXPI) and the lagged one period ratio of export (X) to GNP.

### b. Imports

Whereas the previous model computed imports as the residual of the expenditure identity, this version calculated an import equation similar to the exports equation. The explanatory variables are output and a price variable.

Peso exports and imports are converted into dollar equivalents using identities.

### c. Other Current Account Items

A model is estimated to compute for the net of the remaining current account items (OTHTRD). Owing to their volatility, to consider them exogenous would create too much difficulty in projecting their values.

The formulation recognises the importance of the two major items included in this variable, namely: cost-insurance-freight which is expected to be related to trade volume, and the interest payments on foreign liabilities which is related to the lagged current account balance (CURBAL) - a measure of the change in foreign indebtedness.

### d. Net Factor Income From Abroad

The estimation of an equation for net factor income from abroad (NFIA) is motivated by similar considerations in the determination of OTHTRD. The determinants include external transaction variables such as exports and imports as well as peso value of the current account.

## 10. Statistical Discrepancy

The statistical discrepancy computed as the residual of the expenditure identity, namely:

$$\text{STATD} = \text{GNP} - (\text{CP} + \text{CG} + \text{INVFP} + \text{IGT} + \text{IINV} + \text{X} - \text{M} + \text{NFIA})$$

where:

INVFP	Privately-originated investments;
GNP	Gross national product;
CP	Private consumption expenditures;
CG	Government consumption expenditures;
STATD	Statistical discrepancy;
NFIA	Net factor income from abroad;

IGT	Government-originated investments; and
IINV	Change in inventory stock.

## ***B. The Demographic Submodel***

The demographic submodel is basically an abridged life table driven by the infant mortality rate, and the equations estimating age-specific (female) population using the survivorship functions implied by the life table. The life table employs the Brass logit system using the 1970 life table in Fleiger et al. (1981) as standard.

Age specific fertility rates determine the number of births in each period.

Infant mortality rate, age-specific fertility rates, and the proportion of households living in the rural areas are functions of socio-economic variables. It is through these variables that economic development affects demographic processes and outcomes.

### **1. Proportion of Rural Households**

The proportion of rural households (PROHR) is expected to depend positively on the proportion of employment in the agricultural sector (EMG) to total employment (EMP).

This equation measures the tempo of urbanization in the model.

The data used for the proportion of rural household are derived from the several rounds of the Family Income and Expenditures Survey (FIES).

### **2. Infant Mortality Rate**

The infant mortality rate is determined by GNP per capita, health expenditure per capita, food expenditures per capita, and the proportion of rural households.

### **3. Life Table Functions**

In Paqueo, Herrin and Associates (1984), the Brass logit system was used in generating life table functions. This is adopted in the current model. However, five-year age groups all throughout are used for ages beyond five years. The 1970 life table in Flieger, et al., (1981) is also used as the standard life table<sup>8</sup>.

If  $SL_x$  is the number of survivors from birth to exact age  $x$ , the Brass logit system postulates that the following relationship is true:

$$\text{logit}(SL_x) = \text{ALPHA} + \text{BETA} * \text{logit}(SL_x^*)$$

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<sup>8</sup> Future versions of the model will use the newer life-table estimates presented in Flieger and Cabigon (1994).

where  $SLx^*$  is the proportion of survivors from birth to exact age  $x$  in a standard life table and  $\text{logit}(y) = -5 \cdot \ln((1-y)/y)$ . Boulier and Paqueo (1981) have shown that socioeconomic variables affect the survivorship functions through the parameter ALPHA. To effect this result here, ALPHA may be expressed as a function of INFANM. Note that INFANM is endogenous to socioeconomic variables.

The parameter BETA, on the other hand, is found to be equal to one (1) whenever the time interval between  $SLx$  and  $SLx^*$  is short. Since the model will be used for long-term simulations, this result may not hold all throughout the simulation period. The life tables in Flieger, et al. (1981) are utilized to estimate the values for BETA for 1960 and 1975 considering 1970 as standard. The values for BETA for the other years are computed by linear interpolation using these estimated values. Given the values for ALPHA and BETA (the suffix F refers to female), the whole range of survivorship functions can be computed.

The following relationship computes for the probability of survival for age group 70 years and above:

$$\ln(SURV_{70P}) = \left( \frac{1}{10} \right) \ln \left( \frac{POP_{70P}^{1970}}{POP_{55-60}^{1960} + POP_{60-65}^{1960} + POP_{65-70p}^{1960}} \right)$$

#### 4. Age-group-specific Population

The age-group population is computed as the product of the appropriately lagged age-group population and the corresponding survival probabilities. Only the female population is computed. The male population is computed using the female population and the lagged one period sex ratio.

#### 5. Age-specific Fertility Rates

Age-specific fertility rates are determined by the percentage of married women for the corresponding age-group and the proportion of 25-year olds and above who are college educated<sup>9</sup> and infant mortality rate.

#### 6. Total Number of Households

The total number of households is computed using the sum of the average age-sex-specific headship rates and the age-specific (female) population. The average age-sex-specific headship rates are derived from four surveys, namely: the 1968, 1978, 1983, and the 1993 National Demographic Surveys (NDS).

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<sup>9</sup> The more appropriate variable is the education status of women. This is not yet available for this version of the model.

## 7. Other Identities

The computation of the population growth rate uses five-year intervals. The use of single-year intervals yielded very volatile growth rates, hence, were not very useful for long-run analysis.

The other identities are included to satisfy the needs of the other parts of the model.

### C. Model Estimation and Simulation

E-Views 3.0 was used to estimate and simulate the estimated model. Most equations of the model were estimated by ordinary least squares (OLS) except for the components of the private consumption expenditure and the sectoral output which were estimated by interactive seemingly unrelated regression (SUR). The results of the regressions are contained in Annex B. The model was also solved in E-Views using Gauss-Seidel method.

### D. Model Validation

There are several means of validating model performance. One is through tracking performance of historical simulation. Another is model stability. Tracking ability is commonly measured using two types of assessments. One visually via turning point tracking and the other is through summary statistics. One of the popular statistics used is the Root Mean Percentage Error (RMSPE). This is given by the following equation:

$$RMSPE = \sqrt{\frac{1}{N} \sum_{t=1}^{t=N} \left( \frac{Y_t^s - Y_t^a}{Y_t^a} \right)^2}$$

Another set of tracking statistics is Theil's Inequality coefficient and its decomposition (Pyndyck and Rubinfeld, 1981).

**Table 1** shows the RMSPE and the Theil Inequality coefficients for the key variables in the model.



Table 1  
Tracking Statistics, 1971-1995

Variable	RMSPE	Theil U	Bias (UM)	Variance (US)
GNP	11.20	0.06	0.56	0.05
GDP	11.68	0.06	0.34	0.14
Private Consumption	6.76	0.03	0.55	0.14
Government Consumption	15.71	0.41	0.41	0.22
Private Capital Formation	20.50	0.12	0.10	0.00
Government Capital Formation	11.20	0.06	0.48	0.01
Exports	10.46	0.05	0.02	0.05
Imports	15.36	0.08	0.14	0.46
Full-time labor input	7.48	0.04	0.55	0.01
General Price Level	23.52	0.16	0.54	0.40
Money	18.22	0.05	0.65	0.07
TBill Rates	26.25	0.20	0.38	0.33
Employment	7.50	0.04	0.58	0.15
Population	3.07	0.01	0.61	0.06
Infant Mortality	19.00	0.08	0.54	0.02
TFR	14.63	0.07	0.90	0.00
Proportion of Rural HH	6.29	0.03	0.84	0.04
Labor Force Part, Women	17.31	0.10	0.60	0.01
Share of Agriculture	4.48	0.02	0.29	0.01
Share of Industry	6.97	0.04	0.37	0.33

### ***E. Model Simulations***

To illustrate the usefulness of the model for policy analysis, the model was used to simulate the impact of alternative demographic scenarios on socioeconomic development. In order to make the simulation much more relevant, the simulation results is aligned with the official population forecast produced by the Technical Advisory Group and the NSO Population Projection Unit. The low, medium, high scenarios are based on the assumption that Net Reproduction Rate (NRR) will be equal to 1 by 2010, 2020, and 2030, respectively. It must be noted, however, that the model provides a different fertility scenario assuming private investment grow at 15 percent per annum and GNP grows 5-7 percent between 1995 and 2025. The simulation results under this scenario are given in Annex C.

The simulations highlight several important results, namely:

1. Lower fertility increases GNP and savings per capita as well as investment per worker (Tables 3-5). These results corroborate well-known consequence of rapid population growth.
2. The impact on "full" time unemployment rate and average GNP growth rate is mixed (Tables 6-7). In the near-term, there is a negative impact of population growth rate on the average GNP growth rate and full-time unemployment rate. This appears to be reversed in the latter periods of the simulation<sup>10</sup>.
3. Lower fertility hastens structural transformation (Tables 8-9). The proportion of workers and output in agriculture is lower with lower fertility rates.
4. Lower infant mortality also accompanies lower fertility (Table 10).

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<sup>10</sup> Simulation results from previous versions of the model (e.g., Orbeta (1992), Orbeta (1989)), yielded negative impact all through out the simulation period.

**Table 2**  
**Total Fertility Rate**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	4.22	4.22	0.00	4.22	0.00
2000	3.57	3.27	-9.17	3.74	4.76
2005	3.17	2.74	-15.69	3.42	7.89
2010	2.82	2.29	-23.14	3.13	10.99
2015	2.50	2.06	-21.36	2.86	14.40
2020	2.22	1.99	-11.56	2.62	18.02
2025	2.05	1.92	-6.77	2.39	16.59

**Table 3**  
**GNP Capita**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	12,016	12,016	0.00	12,016	0.00
2000	13,782	13,859	0.56	13,744	-0.28
2005	16,253	16,547	1.78	16,107	-0.90
2010	19,374	20,010	3.18	19,054	-1.65
2015	24,064	25,163	4.37	23,475	-2.45
2020	31,137	32,740	4.90	30,135	-3.22
2025	40,644	42,731	4.88	39,035	-3.96

**Table 4**  
**Total Savings Per Capita\***

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	1,978	1,978	0.00	1,978	0.00
2000	3,091	3,154	2.00	3,060	-1.00
2005	4,612	4,859	5.08	4,487	-2.71
2010	6,721	7,288	7.78	6,435	-4.26
2015	10,242	11,290	9.28	9,686	-5.43
2020	16,084	17,688	9.07	15,106	-6.08
2025	24,796	26,938	7.95	23,183	-6.51

\* Defined as GNP less private and public consumption exp. / population

**Table 5**  
**Total Investment Per Capita\***

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	2,691	2,691	0.00	2,691	0.00
2000	4,658	4,675	0.36	4,650	-0.17
2005	7,730	7,838	1.38	7,675	-0.71
2010	13,194	13,552	2.64	13,008	-1.41
2015	23,310	24,281	4.00	22,786	-2.25
2020	42,229	44,481	5.06	40,867	-3.23
2025	77,807	82,465	5.65	74,468	-4.29

\* Defined as private and public investment exp. / population

**Table 6**  
**"Full-time" Unemployment Rate**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	39.97	39.97	0.00	39.97	0.00
2000	31.74	32.99	3.79	31.16	-1.83
2005	24.19	24.92	2.93	23.86	-1.36
2010	18.96	19.31	1.81	18.81	-0.79
2015	15.16	14.78	-2.57	15.08	-0.53
2020	10.56	9.33	-13.18	10.85	2.75
2025	7.91	6.51	-21.51	8.61	8.85

**Table 7**  
**Average GNP Growth Rate**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1996-2000	5.21	5.29	1.51	5.17	-0.77
2001-2005	5.46	5.54	1.44	5.43	-0.55
2006-2010	5.46	5.48	0.36	5.45	-0.18
2011-2015	6.12	6.05	-1.16	6.14	0.33
2016-2020	6.75	6.60	-2.27	6.81	0.89
2021-2025	6.72	6.57	-2.28	6.81	1.34

**Table 8**  
**Proportion of Workers in Agriculture**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	44.06	44.06	0.00	44.06	0.00
2000	41.37	41.36	-0.02	41.37	0.00
2005	40.20	40.19	-0.02	40.20	0.00
2010	39.72	39.72	0.00	39.72	0.00
2015	39.42	39.40	-0.05	39.44	0.05
2020	39.22	39.15	-0.18	39.27	0.13
2025	39.05	38.92	-0.33	39.14	0.23

**Table 9**  
**Proportion of Output from Agriculture**

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	21.55	21.55	0.00	21.55	0.00
2000	20.06	20.05	-0.05	20.08	0.10
2005	18.85	18.76	-0.48	18.89	0.21
2010	17.85	17.70	-0.85	17.92	0.39
2015	16.73	16.54	-1.15	16.83	0.60
2020	15.49	15.29	-1.31	15.62	0.84
2025	14.27	14.07	-1.42	14.43	1.12

**Table 10**  
**Infant Mortality Rate\***

	Base	Low Fertility		High Fertility	
		Value	% Diff	Value	%Diff
1995	49	49	0.00	49	0.00
2000	43	43	-0.54	43	0.28
2005	34	33	-2.35	34	1.18
2010	26	24	-5.20	26	2.57
2015	17	16	-8.91	18	4.65
2020	9	8	-12.83	10	7.94
2025	4	4	-17.04	5	12.89

\* per thousand live births

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## Annex A

### LIST OF VARIABLES





Variable Name	Description	Units	Source	Period
ALPHAF	The parameter in the Brass Logit System for the female population		See Annex B (model listing) for the formula used	1955-1997
ASFRi	Age Specific Fertility Rates (where i = 15,20,25,30,35,40,45)		1960-1977 – J. Cabigon 1980-1984 - 1983 NDS and 1986 CPS as reported in de Guzman et. Al 1991 - from 1993 NDS In between years were linearly interpolated	1960-1997
BETAF	The parameter in the Brass Logit System for the female population		See Annex B (model listing) for the formula used	1955-1997
BIRF	Total number of live births in a given year		See Annex B (model listing) for the formula used	1955-1997
BIRMF	Average number of female live births in a given year		Computed as $(1/2) * (BIRF + BIRF(-1))$	1956-1997
BOP	Balance of Payments	In mil US\$	BOP-BSP	1970-1997
CAPBAL	Capital Account Balance	In mil US\$	BOP-BSP	1970-1997
CEDG	Current Operating Expenditures in Education	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1985 from Dr. Manasan's paper 1986-1997 lifted from BESF	1955-1997
CG	Government Consumption Expenditures	In mil Pesos 1985=100	NIA-NSCB	1955-1997
CHG	Current Operating Expenditures in Health	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1985 from Dr. Manasan's paper 1986-1997 lifted from BESF	1955-1997
CP	Private Consumption Expenditures	In mil Pesos 1985=100	NIA-NSCB	1955-1997
CPI	Consumer Price Index	1985=100	Philippine Stat Yearbook, various years	1955-1997

Variable Name	Description	Units	Source	Period
CURBAL	Current Account Balance	In mil US\$	BOP-BSP	1956-1997
D25P	Number of Deaths for age 25 and over		Census of Population	1956-1997
DEP	Annual Rate of Depreciation of Capital Stock		Computed as $KCAR(-1)/[KP(-1)+KG(-1)]$	1956-1997
DEPNC	Youth Dependency Ratio	In percent	Computed as $(pf0+pm0+pf1+pm1+pf5+pm5+pf10+pm10)/popt$ , population data from Census of Pop'n and housing (see pdat95.xls)	1955-1997
DEXPI	Dollar price index of Exports	In percent 1985=100	BOP-BSP	1955-1997
DMPI	Dollar price index of Imports	In percent 1985=100	BOP-BSP	1955-1997
DPM	Implicit price index of Imports	In percent 1985=100	NIA-NSCB	1955-1997
DPX	Implicit price index of Exports	In percent 1985=100	NIA-NSCB	1955-1997
EDR	Private Expenditures on Education	In mil Pesos 1985=100	FIES ratios applied to nominal CP and deflated by PED	1957-1997
EDUC	Total government & private expenditures in education	In mil Pesos 1985=100	Computed as $EGEXPR+EDR$	1957-1997
EDRCG	Ratio of Current operating expenditures in education to Government Consumption	In percent	Computed as $CEDG/CG$	1955-1997
EGEXPR	Total government expenditures in education	In mil Pesos 1985=100	Computed as $INEDG+CEDG$	1955-1997

Variable Name	Description	Units	Source	Period
EMG	Employment in Agriculture	In '000	Current Labor Statistics, various issues	1956-1997
EMP	Total Employment	In '000	Yearbook of Labor Statistics	1956-1997
ER	Nominal Peso/Dollar Exchange Rate	₱/US\$	BSP	1955-1997
EXPR	Total Government Expenditures	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1997 from DBM	1955-1997
FINFAM	Five-year moving Average of Infant Mortality Rate		$(\text{INFANM}(-1)+\text{INFANM}(-2)+\text{INFANM}(-3)+\text{INFANM}(-4)+\text{INFANM}(-5))/5$	1959-1997
FODR	Private Food Expenditures	In mil Pesos 1985=100	FIES ratios applied to nominal CP and deflated by PNFOD	1957-1997
FUEMPR	Full-time unemployment Rate	In percent	Computed as $(1-(\text{LABI}/\text{LABS}))*100$	1955-1997
GDCF	Gross Domestic Capital Formation	In mil Pesos 1985=100	NIA-NSCB	1955-1997
GDEF	Government Deficit	In mil Pesos 1985=100	Computed as $\text{EXPR}-\text{REVR}$	1955-1997
GDP	Gross Domestic Product	In mil Pesos 1985=100	NIA-NSCB	1955-1997
GNP	Gross National Product	In mil Pesos 1985=100	NIA-NSCB	1955-1997
HHOLD	Total Number of Households	In '000	See Annex B (model listing) for the formula used	1955-1997
HCG	Ratio of Current Operating Expenditure on Health to Gov't Consumption Expenditures	1985=100	Computed as $\text{CHG}/\text{CG}$	1955-1997
HGEXPR	Total Government Expenditure on Health	1985=100	Computed as $\text{CHG}+\text{INHG}$	1955-1997
HIGT	Ratio of Capital Expenditure on Health to Total Government Fixed Capital Expenditures		Computed as $\text{INHG}/\text{IGT}$	1955-1997

Variable Name	Description	Units	Source	Period
HRCG	Ratio of Current Operating Expenditures on Health to Government Consumption	In percent	Computed as CHG/CG	1955-1997
HPCAP	Per Capita Health Expenditure This includes expenditure of both private and gov't.	1985=100	Computed as (CHG+MEDR)/POP	1955-1997
IGT	Total Government Fixed Capital Expenditures This refers to public expenditures for construction and durable equipment	In mil Pesos 1985=100	Computed as GDCF-INVFP-IINV	1955-1997
IINV	Changes in Stocks	In mil Pesos 1985=100	NIA-NSCB	1955-1997
ILTLON	Inflows of Long-term Loans	Nominal, in mil US\$	BOP-BSP	1967-1997
INEDG	Government Capital Outlay in Education	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1985 from Dr. Manasan's paper 1986-1997 lifted from BESF	1955-1997
INFANM	Infant Mortality Rate (adjusted)	in percent	Computed...see infant.xls	1955-1997
INFL	Rate of Inflation	in percent	Computed as $CPI/CPI(-1) - 1$	1957-1997
INHG	Gov't Capital Expenditure on Health	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1985 from Dr. Manasan's paper 1986-1997 lifted from BESF	1955-1997
INVFP	Gross Private Investment on Fixed Capital Formation This refers to private expenditures on durable equipment and construction.	In mil Pesos 1985=100	Computed as $CONS*(\%CONSPR) + IDER*(\%DERpri)^{**}$	1955-1997

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\* where : CONS- gross domestic capital formation in construction ; %CONSPR-share of private GVA in construction to total GVA in construction (source:NIA)  
IDER – gross domestic capital formation in durable eqpt.; %DERpri- share of private sector in gdcf on durable eqpt (source:NIA)

Variable Name	Description	Units	Source	Period
INVG	Non-education government capital expenditure	In mil Pesos 1985=100	Computed as IGT-INEDG	1955-1997
INVPY	Private Sector Inventory	In mil Pesos 1985=100	Computed as (IINV/INVFP)*KP	1955-1997
KCAR	Capital Consumption Allowance	In mil Pesos 1985=100	NIA-NSCB	1955-1997
KG	Government Capital Stock	In mil Pesos 1985=100	Computed as (1-DEP)*KG(-1) + INVG	1955-1997
KP	Private Capital Stock	In mil Pesos 1985=100	Computed as (1-DEP)*KP(-1) + INVFP	1955-1997
KT	Total Capital Stock	In mil Pesos 1985=100	Computed as KP+KG	1955-1997
LABI	Labor Force employed 40 hrs & over	In thousands	ISH-LFS	1956-1997
LABS	Total # of Persons 15 yrs old & over in the Labor Force	In thousands	LABSF+LABSM	1960-1997
LABSF	Labor Supply (Female)	In thousands	POPF15P*LFPRF	1956-1997
LABSM	Labor Supply (Male)	In thousands	POPM15P*LFPRM	1960-1997
LAND	Demand for Land Cultivation	In hectares	Philippine Statistical Yearbook	1955-1997
LIBOR	London inter-bank offered rate	In percent	BSP	1970-1997
LFPRM	Labor Force Participation Rate (Male)	In percent	1955-1986 from Dr. Orbeta's data base 1987-1997: Yearbook of Labor Statistics	1955-1997
LFPRF	Labor Force Participation Rate (Female)	In percent	1955-1986 from Dr. Orbeta's data base 1987-1997: Yearbook of Labor Statistics	1955-1997
M	Peso Value of imports	In mil Pesos 1985=100	NIA-NSCB	1955-1997

Variable Name	Description	Units	Source	Period
MB	Base Money	In mil Pesos	NDA+NFA	1967-1997
MD	Dollar Value of Imports	Nominal, in mil US\$	1955-1971 from Dr. Orbeta's data base 1972-1997 from Selected Phil. Econ indicators, BSP	1955-1997
MEDR	Private Expenditures on Health	In mil Pesos 1985=100	FIES ratios applied to nominal CP and deflated by PMED	1957-1997
MFRi	Male Female Ratio (i=0,1,15,10,15,20,25,30,35,40,45,50, 55,60,65,70+)		Pmi/PFi	1955-1997
MS	Money Supply (M1)	In mil Pesos	1956-1969 from Dr. Orbeta's data base 1970-1997 from Selected Phil. Econ indicators, BSP	1956-1997
NDA	Net Domestic Asset of the BSP	In mil Pesos	1967-1997 from Selected Phil. Econ indicators, BSP	1967-1997
NFA	Net Foreign Asset of the BSP	In mil Pesos	1967-1997 from Selected Phil. Econ Indicators, BSP	1967-1997
NFIA	Net Foreign Income from Abroad	In mil Pesos 1985=100	NIA-NSCB	1955-1997
NHEXP	Gov't Expenditure net of Health Expenditure	In mil Pesos 1985=100	Computed as EXP-RHEXP	1955-1997
NTAXR	Non-tax Revenues	In mil Pesos 1985=100	Computed as REVR-TAXR	1955-1997
NTXRR	Non-tax Revenue/GNP			1955-1997
NTXRR1	Non-tax Revenue/ Revenues			1955-1997
OLTLON	Outflow of Long-term Loan	Nominal in mil US\$	BOP-BSP	1967-1997
OTHR	Private Expenditures on Other Goods	in mil Pesos		1957-1997

Variable Name	Description	Units	Source	Period
		1985=100		
OTHTRD	Other Trade Accounts	In mil US\$	1955-1971 from Dr. Orbeta's data base 1972-1997 from Selected Phil. Econ indicators, BSP	1955-1997
P25P	Population 25 Years old and over	In '000	Computed as PF25+PF30+PF35+PF40+PF45+PF50+ PF55+PF60+PF65+PF70P+PM25+PM3 0+PM35+PM40+PM45+PM50+PM55+ PM60+PM65+PM70P	1955-1997
PCP	CP Implicit Price Index	1985=100	NIA-NSCB	1955-1997
PED	GVA in Educ. Services IPI	1985=100	NIA-NSCB	1955-1997
PEC25	Proportion of 25 years old & above who completed college	In '000	Computed	1960-1997
PF	Female Population	In '000	Computed	
PGDP	GDP Implicit Price Index	1985=100	NIA-NSCB	1955-1997
PGNP1	GNP Implicit Price Index	1985=100	NIA-NSCB	1955-1997
PGDCF	GDCF Implicit Price Index	1985=100	NIA-NSCB	1955-1997
PMED	GVA in Medical Services IPI	1985=100	NIA-NSCB	1955-1997
PMadj	Import Price adjuster		Computed as (MD*ER)/M	1955-1997
PNFOD	Food Price Index	1985=100	Philippine Stat Yearbook, various years	1955-1997
POPF15P	Population (Female)15 yrs old and above	In '000	Census of Popuation & Housing, in b/n years linearly interpolated ...see pdat95.xls	1955-1997
POPM15P	Population (Male)15 yrs old and above	In '000	Census of Popuation & Housing, in b/n years linearly interpolated ...see pdat95.xls	1955-1997
POP1564	Population ages 15 to 64 years old	In '000	Computed	1955-1997

Variable Name	Description	Units	Source	Period
POP0014	Population ages 0-14 years old	In '000	Computed	1955-1997
POP65P	Population age 65 years and above	In '000	Computed	1955-1997
POPGR	Population Growth	In percent	Computed	1955-1997
POPT	Total Population	In '000	Census of Population & Housing, in b/n years linearly interpolated ...see pdat95.xls	1955-1997
PRFOD	Price Index of food (Real)	1985=100	PNFOD/CPI	1957-1997
PRINV1	PGDP/PGNP1		Computed	1955-1997
PROHR	Proportion of Rural Household		PSY	1957-1997
Pxadj	Export Prices adjuster		Computed as (XD*ER)/X	1955-1997
P*i	Age-Specific Population (where * =M (male) or F(female) and i= 0,5,10,15,20,25,30,35,40,45,50,55, 60,65,70+)	In '000	Census of Population & Housing, in b/n years linearly interpolated ...see pdat95.xls	1955-1997
REVR	Total Government Revenues	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1997 from DBM	1955-1997
RM	Reserve Money	Nominal	BSP Publication	1967-1997
SLFx	Number of female survivors from birth to age x in the life table Where x=5,10,15,20,25,30,35,40,45,50,55, 60,65,70+		See Annex B (model listing) for the formula used	1956-1997
SAVD	Total Domestic Savings	1985=100 MP	NIA-NSCB	1955-1997
STATD	Statistical Discrepancy	In mil Pesos 1985=100	NIA-NSCB	1955-1997
SVAR	Share of Agriculture	in %	(VAR/GDP)*100	1955-1997



Variable Name	Description	Units	Source	Period
SVIR	Share of Industry	in %	(VIR/GDP)*100	1955-1997
SVSR	Share of Services	in %	(VSR/GDP)*100	1955-1997
TAXR	Tax Revenues	In mil Pesos 1985=100	1955-1974 from Dr. Orbeta's data base 1975-1997 from DBM	1955-1997
TAXRR	Tax Revenue/GNP	in %		1955-1997
TAXRR1	Tax Revenue/Revenues	in %		1955-1997
TBILL	90-day Treasury Bill Rates	In %	BSP	1970-1997
TFR	Total Fertility Rates	Per 1,000	Computed	1955-1997
UNEMPR	Unemployment Rate	In %	Computed as $(1-(EMP/LABS))*100$	1960-1997
USINFL	US Inflation Rate	In %	IMF-IFS	1968-1997
VAR	Value Added in Agriculture	In mil Pesos 1985=100	NIA-NSCB	1955-1997
VIR	Value Added in Industry	In mil Pesos 1985=100	NIA-NSCB	1955-1997
VSR	Value Added in Services	In mil Pesos 1985=100	NIA-NSCB	1955-1997
W	Implied Wage Rate	In Pesos	Derived from the Production Function	1955-1997
WAGEL	Legislated wage rates of non-agri workers	In Pesos	1955-1971 from Dr. Orbeta's data base 1972-1997 from Selected Phil. Econ indicators, BSP	1955-1997
WAGN	Wage Rate of Agricultural Workers	In Pesos	1956-1984 from Dr. Orbeta's data base 1985-1995 from Current Labor Statistics, various issues	1956-1997
WLAGRI	Legislated wage rates of agri workers	In Pesos	1955-1971 from Dr. Orbeta's data base 1972-1997 from Selected Phil. Econ indicators, BSP	1955-1997
WWAGN	Weighted legislated wage (nominal)	In Pesos	Computed as $WLAGN*(EMG/EMP) +$	1956-1997

Variable Name	Description	Units	Source	Period
			WUSN* (EMP-EMG)/EMP	
WWAGR	Weighted Daily Wage Rate (real)	In Pesos	Computed as WWAGN/CPI	1957-1997
WUSN	Wage of unskilled workers	In Pesos	1967-1980 from CB Statistical Bulletin. 1981-1997, growth rate of legislated wage rate (WAGEL) was applied to continue the series	
X	Exports in Pesos	In mil Pesos 1985=100	NIA-NSCB	1955-1997
XD	Exports in Dollars	Nominal, in mil US\$	1955-1971 from Dr. Orbeta's data base 1972-1997 from Selected Phil. Econ indicators, BSP	1955-1997

## Annex B

# EQUATION LIST

## I. Economic Submodel :

### A. Identities:

```

gdp=gnp-nfia
labi=(prodfunc_a.@coefs(3))*(gnp/w)
labism=lfprm*popm15p
labssf=lfprf*popf15p
labs=labism+labssf
wwagn=wlagri*(emg/emp)+wagel*(emp-emg)/emp
ww=wagn*(emg/emp)+wusn*(emp-emg)/emp
fuempr=(1-(labi/labs))*100
unempr=(1-(emp/labs))*100
othr=cp-edr-medr-fodr
igt=invg+inedg
inedg=iergnp*gnp
invg=inrgnp*gnp
gdcf=invfp+igt+iinv
dep=kcar(-1)/(kp(-1)+kg(-1))
kp=(1-dep)*(kp(-1))+invfp
kg=(1-dep)*(kg(-1))+invg
invpy=invpy(-1)+iinv(-1)
infl=((cpi/cpi(-1))-1)*100
taxr=taxrr*gnp
ntaxr=ntxrr*gnp
revr=ntaxr+taxr
cedg=edrcg*cg
chg=hrcg*cg
egexpr=inedg+cedg
expr=cg+igt
gdef=expr-revr
var=(svar/100)*gdp
vir=(svir/100)*gdp
vsr=gdp-var-vir
svsr=(vsr/gdp)*100
statd=gnp-(cp+cg+invfp+igt+iinv+x-m+nfia)
xd=(pxadj*x*dpx)/er
md=(pmadj*m*dpm)/er
curbal=xd-md+othtrd
hpcap=(chg+medr)/popt
egexpr=inedg+cedg
educ=egexpr+edr
ec25=ec25(-1)*(1-(d25p/p25p))+(educ(-1)*1000)/73198.3748
pec25=(ec25/p25p)*100
popf=pf0+pf1+pf5+pf10+pf15+pf20+pf25+pf30+pf35+pf40+pf45+pf50+pf55+pf60+pf65+
pf70p
popm=pm0+pm1+pm5+pm10+pm15+pm20+pm25+pm30+pm35+pm40+pm45+pm50+p
m55+pm60+pm65+pm70p
popt=popm+popf
depnc=(pf0+pm0+pf1+pm1+pf5+pm5+pf10+pm10)/popt

```

$\text{popf15p} = \text{pf15} + \text{pf20} + \text{pf25} + \text{pf30} + \text{pf35} + \text{pf40} + \text{pf45} + \text{pf50} + \text{pf55} + \text{pf60} + \text{pf65} + \text{pf70p}$   
 $\text{popm15p} = \text{pm15} + \text{pm20} + \text{pm25} + \text{pm30} + \text{pm35} + \text{pm40} + \text{pm45} + \text{pm50} + \text{pm55} + \text{pm60} + \text{pm65} + \text{p}$   
 $\text{m70p}$   
 $\text{p25p} = \text{pf25} + \text{pf30} + \text{pf35} + \text{pf40} + \text{pf45} + \text{pf50} + \text{pf55} + \text{pf60} + \text{pf65} + \text{pf70p} + \text{pm25} + \text{pm30} + \text{pm35} + \text{p}$   
 $\text{m40} + \text{pm45} + \text{pm50} + \text{pm55} + \text{pm60} + \text{pm65} + \text{pm70p}$   
 $\text{d25p} = \text{p25p} - \text{p25p}(-1) + ((\text{pf20}(-1) + \text{pm20}(-1))/5)$

## B. Behavioral Equations

:gnpeq  
:empeq  
:emgeq1  
:wusneq  
:wagneq  
:wageleq  
:wlagrieq  
:weq  
:lfprfeq  
:cpeq  
:consump  
:invfpeq  
:cgeq  
:kcareq  
:iinveq  
:pgnp1eq  
:cpieq  
:prinveq  
:dpmeq  
:dpxeq  
:landeq  
:svareq  
:svireq  
mb=.1\*(gnp\*(pgnp1/100))  
:mseq  
:tbilleq  
:xeq  
:meq  
:othtrdeq  
nfia=.04\*gnp

## II. Demographic Submodel :

### A. Identities

```

tfr=((asfr15+asfr20+asfr25+asfr30+asfr30+asfr40+asfr45)/1000)*5
alphaf=.5*log((.00101*infanm)/(1-(.00101*infanm)))+1.174535*betaf
betaf=(1.03935-.003935*(time-5))*(1-tdum)+(1-.00155*(time-15))*tdum
slf5=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.87115)/.87115))))^(-1)
slf10=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.85820)/.85820))))^(-1)
slf15=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.85077)/.85077))))^(-1)
slf20=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.84218)/.84218))))^(-1)
slf25=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.83096)/.83096))))^(-1)
slf30=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.81604)/.81604))))^(-1)
slf35=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.79717)/.79717))))^(-1)
slf40=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.77364)/.77364))))^(-1)
slf45=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.74465)/.74465))))^(-1)
slf50=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.70970)/.70970))))^(-1)
slf55=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.66673)/.66673))))^(-1)
slf60=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.61202)/.61202))))^(-1)
slf65=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.53876)/.53876))))^(-1)
slf70p=(1+exp((2*alphaf(-1))+2*betaf*(.5*log((1-.44519)/.44519))))^(-1)
pf0=birmf(-1)*(1-(.00073*infanm(-1)))
pf1=pf0(-4)*((1.218-.001196*infanm(-1))+2.782*slf5)/(1-(.00073*infanm(-1)))
pf5=pf1(-5)*((5/2)*(slf5+slf10))/(1.218-.001196*infanm(-1)+2.782*slf5)
pf10=pf5(-5)*((slf10+slf15)/(slf5+slf10))
pf15=pf10(-5)*((slf15+slf20)/(slf10+slf15))
pf20=pf15(-5)*((slf20+slf25)/(slf15+slf20))
pf25=pf20(-5)*((slf25+slf30)/(slf20+slf25))
pf30=pf25(-5)*((slf30+slf35)/(slf25+slf30))
pf35=pf30(-5)*((slf35+slf40)/(slf30+slf35))
pf40=pf35(-5)*((slf40+slf45)/(slf35+slf40))
pf45=pf40(-5)*((slf45+slf50)/(slf40+slf45))
pf50=pf45(-5)*((slf50+slf55)/(slf45+slf50))
pf55=pf50(-5)*((slf55+slf60)/(slf50+slf55))
pf60=pf55(-5)*((slf60+slf65)/(slf55+slf60))
pf65=pf60(-5)*((slf65+slf70p)/(slf60+slf65))
pf70p=pf65(-5)*(slf70p/((5/2)*(slf65+slf70p)))+(pf70p(-5)*.947188)
pm0=pf0*mfr0(-1)
pm1=pf1*mfr1(-1)
pm5=pf5*mfr5(-1)
pm10=pf10*mfr10(-1)
pm15=pf15*mfr15(-1)
pm20=pf20*mfr20(-1)
pm25=pf25*mfr25(-1)
pm30=pf30*mfr30(-1)
pm35=pf35*mfr35(-1)
pm40=pf40*mfr40(-1)
pm45=pf45*mfr45(-1)
pm50=pf50*mfr50(-1)
pm55=pf55*mfr55(-1)

```

```

pm60=pf60*mfr60(-1)
pm65=pf65*mfr65(-1)
pm70p=pf70p*mfr70p(-1)
mfr0=pm0/pf0
mfr1=pm1/pf1
mfr5=pm5/pf5
mfr10=pm10/pf10
mfr15=pm15/pf15
mfr20=pm20/pf20
mfr25=pm25/pf25
mfr30=pm30/pf30
mfr35=pm35/pf35
mfr40=pm40/pf40
mfr45=pm45/pf45
mfr50=pm50/pf50
mfr55=pm55/pf55
mfr60=pm60/pf60
mfr65=pm65/pf65
mfr70p=pm70p/pf70p
finfam=(infanm(-1)+infanm(-2)+infanm(-3)+infanm(-4)+infanm(-5))/5
birf=(.4878/1000)*(asfr15*pf15+asfr20*pf20+asfr25*pf25+asfr30*pf30+asfr35*pf35+asfr40*pf40+asfr45*pf45)
birmf=(1/2)*(birf+birf(-1))
popf=pf0+pf1+pf5+pf10+pf15+pf20+pf25+pf30+pf35+pf40+pf45+pf50+pf55+pf60+pf65+pf70p
popm=pm0+pm1+pm5+pm10+pm15+pm20+pm25+pm30+pm35+pm40+pm45+pm50+pm55+pm60+pm65+pm70p
popt=popm+popf
depnc=(pf0+pm0+pf1+pm1+pf5+pm5+pf10+pm10)/popt
popf15p=pf15+pf20+pf25+pf30+pf35+pf40+pf45+pf50+pf55+pf60+pf65+pf70p
popm15p=pm15+pm20+pm25+pm30+pm35+pm40+pm45+pm50+pm55+pm60+pm65+pm70p
popgr=((popt/popt(-5))^(0.2))-1)*100
hhold=0.00973*pf15+.016227*pf20+.55700*pf25+.81933*pf30+.94767*pf35+1.00967*pf40+1.05667*pf45+1.10500*pf50+1.14900*pf55+1.11733*pf60+1.05900*pf65+1.05900*pf70p
p25p=pf25+pf30+pf35+pf40+pf45+pf50+pf55+pf60+pf65+pf70p+pm25+pm30+pm35+pm40+pm45+pm50+pm55+pm60+pm65+pm70p
d25p=p25p-p25p(-1)+((pf20(-1)+pm20(-1))/5)

```



**B. Behavioral Equations**

:ruralhh  
:infamort  
:asfr15eq  
:asfr20eq  
:asfr25eq  
:asfr30eq  
:asfr35eq  
:asfr40eq  
:asfr45eq

**ECONOMIC SUBMODEL: Estimated Behavioral Equations**

Equation: GNPEQ

Dependent Variable: LOG(GNP)

Method: Least Squares

Date: 11/27/98 Time: 08:43

Sample(adjusted): 1961 1997

Included observations: 37 after adjusting endpoints

Convergence achieved after 12 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.456334	0.979841	3.527443	0.0013
LOG(KP+KG)	0.439747	0.126890	3.465572	0.0015
LOG(LABI*PEC25^(.8)*HPCAP^(.2))	0.314343	0.146104	2.151505	0.0391
D8488	-0.077553	0.022799	-3.401571	0.0018
AR(1)	0.845346	0.091459	9.242871	0.0000
R-squared	0.995552	Mean dependent var	13.09962	
Adjusted R-squared	0.994996	S.D. dependent var	0.414495	
S.E. of regression	0.029321	Akaike info criterion	-4.095928	
Sum squared resid	0.027511	Schwarz criterion	-3.878236	
Log likelihood	80.77466	F-statistic	1790.534	
Durbin-Watson stat	1.482397	Prob(F-statistic)	0.000000	
Inverted AR Roots	.85			

Equation: EMPEQ

Dependent Variable: LOG(EMP)

Method: Least Squares

Date: 09/21/98 Time: 11:29

Sample(adjusted): 1957 1997

Included observations: 41 after adjusting endpoints

Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.759679	0.574641	1.322005	0.1941
LOG(LABI)	0.962354	0.061965	15.53070	0.0000
AR(1)	0.673507	0.118678	5.675103	0.0000
R-squared	0.984642	Mean dependent var	9.614279	
Adjusted R-squared	0.983834	S.D. dependent var	0.370880	
S.E. of regression	0.047156	Akaike info criterion	-3.200357	
Sum squared resid	0.084500	Schwarz criterion	-3.074974	
Log likelihood	68.60733	F-statistic	1218.157	
Durbin-Watson stat	2.274007	Prob(F-statistic)	0.000000	
Inverted AR Roots	.67			

Equation : EMGEQ1

Dependent Variable: EMG/EMP

Method: Least Squares

Date: 12/03/98 Time: 10:40

Sample(adjusted): 1958 1996

Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.118716	0.078641	1.509597	0.1401
VAR/GDP	0.088665	0.262622	0.337615	0.7377
WAGN(-1)/WW(-1)	-0.053185	0.040231	-1.321996	0.1947
EMG(-1)/EMP(-1)	0.803490	0.115796	6.938839	0.0000
R-squared	0.852689	Mean dependent var		0.526748
Adjusted R-squared	0.840062	S.D. dependent var		0.055700
S.E. of regression	0.022276	Akaike info criterion		-4.673733
Sum squared resid	0.017367	Schwarz criterion		-4.503111
Log likelihood	95.13780	F-statistic		67.53065
Durbin-Watson stat	2.170027	Prob(F-statistic)		0.000000

Equation : WUSNEQ

Dependent Variable: WUSN

Method: Least Squares

Date: 10/13/98 Time: 19:47

Sample(adjusted): 1961 1997

Included observations: 37 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.74929	6.000794	-2.124601	0.0412
CPI	0.236114	0.047559	4.964618	0.0000
LABI(-1)/LABS(-1)	22.86484	9.460991	2.416749	0.0214
WUSN(-1)	0.351320	0.147207	2.386563	0.0229
R-squared	0.994980	Mean dependent var		28.71232
Adjusted R-squared	0.994523	S.D. dependent var		27.27135
S.E. of regression	2.018216	Akaike info criterion		4.344111
Sum squared resid	134.4154	Schwarz criterion		4.518264
Log likelihood	-76.36605	F-statistic		2180.085
Durbin-Watson stat	1.302934	Prob(F-statistic)		0.000000

Equation : WAGRIEQ  
 Dependent Variable: WAGN  
 Method: Least Squares  
 Date: 10/13/98 Time: 19:52  
 Sample(adjusted): 1961 1995  
 Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.679226	2.705158	-2.469071	0.0193
CPI	0.094674	0.019862	4.766536	0.0000
LABI(-1)/LABS(-1)	9.264651	3.983465	2.325777	0.0267
WAGN(-1)	0.854440	0.059078	14.46285	0.0000
R-squared	0.998784	Mean dependent var		21.54186
Adjusted R-squared	0.998666	S.D. dependent var		25.21092
S.E. of regression	0.920848	Akaike info criterion		2.780167
Sum squared resid	26.28680	Schwarz criterion		2.957921
Log likelihood	-44.65293	F-statistic		8484.586
Durbin-Watson stat	1.298641	Prob(F-statistic)		0.000000

Equation: WAGELEQ  
 Dependent Variable: WAGEL  
 Method: Least Squares  
 Date: 10/27/98 Time: 10:52  
 Sample(adjusted): 1958 1997  
 Included observations: 40 after adjusting endpoints  
 Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.654328	6.942375	-0.526380	0.6018
WUSN	1.800373	0.064051	28.10824	0.0000
AR(1)	0.946266	0.069793	13.55827	0.0000
R-squared	0.999297	Mean dependent var		43.50494
Adjusted R-squared	0.999259	S.D. dependent var		50.86970
S.E. of regression	1.385076	Akaike info criterion		3.561425
Sum squared resid	70.98211	Schwarz criterion		3.688091
Log likelihood	-68.22851	F-statistic		26284.53
Durbin-Watson stat	1.327208	Prob(F-statistic)		0.000000
Inverted AR Roots	.95			

Equation: WLAGRIEQ  
 Dependent Variable: WLAGRI  
 Method: Least Squares  
 Date: 10/27/98 Time: 10:53  
 Sample(adjusted): 1957 1995  
 Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.794992	0.767304	1.036084	0.3071
WAGN	0.205256	0.248223	0.826899	0.4137
WLAGRI(-1)	0.916266	0.192158	4.768306	0.0000
R-squared	0.989029	Mean dependent var		27.37769
Adjusted R-squared	0.988419	S.D. dependent var		34.26055
S.E. of regression	3.686895	Akaike info criterion		5.521250
Sum squared resid	489.3551	Schwarz criterion		5.649216
Log likelihood	-104.6644	F-statistic		1622.668
Durbin-Watson stat	1.375145	Prob(F-statistic)		0.000000

Equation: WEQ  
 Dependent Variable: LOG(W)  
 Method: Least Squares  
 Date: 12/02/98 Time: 11:21  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.085618	0.151551	0.564946	0.5757
LOG(LABI/LABS)	0.130970	0.109608	1.194888	0.2402
LOG(W(-1))	0.992993	0.067305	14.75370	0.0000
R-squared	0.907053	Mean dependent var		2.669680
Adjusted R-squared	0.901741	S.D. dependent var		0.132663
S.E. of regression	0.041585	Akaike info criterion		-3.446502
Sum squared resid	0.060526	Schwarz criterion		-3.317219
Log likelihood	68.48355	F-statistic		170.7785
Durbin-Watson stat	1.229236	Prob(F-statistic)		0.000000

Equation: LFPRFEQ  
 Dependent Variable: LOG(LFPRF)  
 Method: Least Squares  
 Date: 12/02/98 Time: 11:36  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.713608	1.297194	1.321011	0.1959
LOG(WWAGN/(CPI/100))	0.132139	0.099700	1.325361	0.1944
LOG(PEC25)	0.422587	0.127019	3.326948	0.0022
LOG((KP+KG)/POPT)	-0.963996	0.360501	-2.674047	0.0117
LOG(LABI/LABS)	-1.146609	0.298203	-3.845062	0.0005
LOG(TFR)	-0.797895	0.314335	-2.538358	0.0162
R-squared	0.670969	Mean dependent var	-0.833224	
Adjusted R-squared	0.619557	S.D. dependent var	0.113899	
S.E. of regression	0.070253	Akaike info criterion	-2.329493	
Sum squared resid	0.157935	Schwarz criterion	-2.070926	
Log likelihood	50.26036	F-statistic	13.05103	
Durbin-Watson stat	0.945576	Prob(F-statistic)	0.000001	

Equation: CPEQ  
 Dependent Variable: LOG(CP/POPT)  
 Method: Least Squares  
 Date: 12/02/98 Time: 12:00  
 Sample(adjusted): 1970 1997  
 Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.120293	0.419583	-2.670014	0.0137
LOG(GNP-REVR-KCAR)	0.212641	0.048624	4.373175	0.0002
LOG(DEPNC)	0.541138	0.129610	4.175135	0.0004
LOG(TBILL/(PGNP/100))	-0.031734	0.007123	-4.454938	0.0002
LOG(CP(-1)/POPT(-1))	0.488055	0.115352	4.231026	0.0003
R-squared	0.988239	Mean dependent var	2.085195	
Adjusted R-squared	0.986193	S.D. dependent var	0.089627	
S.E. of regression	0.010531	Akaike info criterion	-6.108483	
Sum squared resid	0.002551	Schwarz criterion	-5.870590	
Log likelihood	90.51877	F-statistic	483.1397	
Durbin-Watson stat	1.092984	Prob(F-statistic)	0.000000	

Equation: CONSUMP  
System: CONSUMP  
Estimation Method: Seemingly Unrelated Regression  
Date: 10/16/98  
Time: 13:46  
Sample: 1957 1997

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.015229	0.022431	-0.678922	0.4986
C(2)	0.003062	0.001757	1.742998	0.0841
C(4)	-0.015932	0.003886	-4.100341	0.0001
C(5)	0.001627	0.000348	4.679327	0.0000
C(6)	0.703317	0.061859	11.36962	0.0000
C(7)	0.282188	0.134507	2.097938	0.0381
C(8)	-0.014482	0.007528	-1.923789	0.0569
C(9)	0.810281	0.092893	8.722723	0.0000

Determinant residual covariance 6.80E-15

Equation:  $EDR/CP = C(1) + C(2) * \log(CP/(DEPNC/0.45719))$

Observations: 41

R-squared	0.070331	Mean dependent var	0.023829
Adjusted R-squared	0.046493	S.D. dependent var	0.006224
S.E. of regression	0.006078	Sum squared resid	0.001441
Durbin-Watson stat	0.113146		

Equation:  $MEDR/CP = C(4) + C(5) * \log(CP/(DEPNC/0.45719)) + C(6) * (MEDR(-1)/CP(-1))$

Observations: 40

R-squared	0.895013	Mean dependent var	0.016439
Adjusted R-squared	0.889338	S.D. dependent var	0.002736
S.E. of regression	0.000910	Sum squared resid	3.07E-05
Durbin-Watson stat	1.303480		

Equation:  $FODR/CP = C(7) + C(8) * \log(CP/(DEPNC/0.45719)) + C(9) * (FODR(-1)/CP(-1))$

Observations: 40

R-squared	0.822584	Mean dependent var	0.520729
Adjusted R-squared	0.812994	S.D. dependent var	0.042296
S.E. of regression	0.018290	Sum squared resid	0.012378
Durbin-Watson stat	1.458328		

Equation: INVFP EQ  
 Dependent Variable: LOG(INVFP)  
 Method: Least Squares  
 Date: 12/02/98 Time: 12:36  
 Sample(adjusted): 1957 1997  
 Included observations: 41 after adjusting endpoints  
 Convergence achieved after 10 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.128491	1.554883	-1.368908	0.1795
LOG(GNP(-1))	1.020221	0.118070	8.640783	0.0000
LOG(PRINV)	-0.717456	0.786978	-0.911659	0.3680
D8586	-0.217240	0.103858	-2.091712	0.0436
AR(1)	0.618862	0.138548	4.466768	0.0001
R-squared	0.953167	Mean dependent var	11.05283	
Adjusted R-squared	0.947964	S.D. dependent var	0.533854	
S.E. of regression	0.121780	Akaike info criterion	-1.259355	
Sum squared resid	0.533892	Schwarz criterion	-1.050383	
Log likelihood	30.81677	F-statistic	183.1739	
Durbin-Watson stat	1.914682	Prob(F-statistic)	0.000000	
Inverted AR Roots	.62			

Equation: CGEQ  
 Dependent Variable: CG  
 Method: Least Squares  
 Date: 12/02/98 Time: 12:42  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints  
 Convergence achieved after 11 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3384.634	18724.24	-0.180762	0.8576
POPT	0.841885	0.339460	2.480069	0.0179
REVR	0.075938	0.051749	1.467427	0.1509
D8891	2292.827	1236.747	1.853918	0.0720
D8488	-3185.317	1551.711	-2.052777	0.0474
AR(1)	0.936997	0.061433	15.25242	0.0000
R-squared	0.991806	Mean dependent var	38311.43	
Adjusted R-squared	0.990668	S.D. dependent var	17526.89	
S.E. of regression	1693.125	Akaike info criterion	17.83810	
Sum squared resid	1.03E+08	Schwarz criterion	18.08634	
Log likelihood	-368.6002	F-statistic	871.5104	
Durbin-Watson stat	1.642887	Prob(F-statistic)	0.000000	
Inverted AR Roots	.94			



Equation: KCAREQ  
 Dependent Variable: KCAR  
 Method: Least Squares  
 Date: 09/07/98 Time: 15:39  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1913.472	762.7867	-2.508528	0.0165
KP+KG	0.063458	0.010285	6.169794	0.0000
KP(-1)+KG(-1)	-0.060308	0.010102	-5.969950	0.0000
KCAR(-1)	0.848447	0.059178	14.33721	0.0000
R-squared	0.996656	Mean dependent var	33980.36	
Adjusted R-squared	0.996393	S.D. dependent var	24655.14	
S.E. of regression	1480.840	Akaike info criterion	17.52900	
Sum squared resid	83329755	Schwarz criterion	17.69449	
Log likelihood	-364.1090	F-statistic	3775.777	
Durbin-Watson stat	1.632007	Prob(F-statistic)	0.000000	

Equation: IINVEQ  
 Dependent Variable: IINV  
 Method: Least Squares  
 Date: 09/09/98 Time: 16:38  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints  
 Convergence achieved after 10 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48121.92	125436.8	0.383635	0.7033
INVPY/GNP	-127785.2	36898.94	-3.463113	0.0013
AR(1)	0.977427	0.061799	15.81618	0.0000
R-squared	0.756305	Mean dependent var	7365.619	
Adjusted R-squared	0.743808	S.D. dependent var	9111.910	
S.E. of regression	4612.031	Akaike info criterion	19.77947	
Sum squared resid	8.30E+08	Schwarz criterion	19.90359	
Log likelihood	-412.3689	F-statistic	60.51812	
Durbin-Watson stat	1.604465	Prob(F-statistic)	0.000000	
Inverted AR Roots	.98			

Equation: PGNP1EQ  
 Dependent Variable: PGNP1  
 Method: Least Squares  
 Date: 12/02/98 Time: 12:53  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.443657	6.193215	-1.363372	0.1810
MS/(GNP*(PGNP1/10 0))	67.77105	46.85934	1.446265	0.1565
WWAGN	0.508703	0.233892	2.174945	0.0361
DPM	0.804882	0.148585	5.416994	0.0000
D8996	6.631470	4.088622	1.621933	0.1133
R-squared	0.996857	Mean dependent var		68.18097
Adjusted R-squared	0.996518	S.D. dependent var		80.52712
S.E. of regression	4.752090	Akaike info criterion		6.066390
Sum squared resid	835.5474	Schwarz criterion		6.273255
Log likelihood	-122.3942	F-statistic		2934.079
Durbin-Watson stat	1.545977	Prob(F-statistic)		0.000000

Equation: CPIEQ  
 Dependent Variable: CPI  
 Method: Least Squares  
 Date: 10/13/98 Time: 19:59  
 Sample(adjusted): 1958 1997  
 Included observations: 40 after adjusting endpoints  
 Convergence achieved after 4 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.264638	1.087762	-0.243286	0.8091
PGNP1	0.982427	0.008627	113.8780	0.0000
AR(1)	0.678345	0.122490	5.537964	0.0000
R-squared	0.999601	Mean dependent var		69.74216
Adjusted R-squared	0.999580	S.D. dependent var		79.73066
S.E. of regression	1.634744	Akaike info criterion		3.892888
Sum squared resid	98.87837	Schwarz criterion		4.019554
Log likelihood	-74.85776	F-statistic		46367.38
Durbin-Watson stat	1.580857	Prob(F-statistic)		0.000000
Inverted AR Roots	.68			

Equation: PRINVEQ  
 Dependent Variable: LOG(PRINV)  
 Method: Least Squares  
 Date: 10/26/98 Time: 10:29  
 Sample(adjusted): 1970 1997  
 Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.193080	0.067623	2.855245	0.0087
LOG(TBILL/(PGNP1/ 100))	0.050890	0.006943	7.329404	0.0000
LOG(TAXRR(-1))	0.147715	0.038178	3.869149	0.0007
LOG(DPM/PGNP1)	0.152542	0.047457	3.214315	0.0037
R-squared	0.852583	Mean dependent var		0.036550
Adjusted R-squared	0.834156	S.D. dependent var		0.052384
S.E. of regression	0.021333	Akaike info criterion		-4.725561
Sum squared resid	0.010922	Schwarz criterion		-4.535246
Log likelihood	70.15785	F-statistic		46.26773
Durbin-Watson stat	1.409393	Prob(F-statistic)		0.000000

Equation: DPMEQ  
 Dependent Variable: LOG(DPM)  
 Method: Least Squares  
 Date: 10/26/98 Time: 17:57  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.901960	1.979102	-1.971581	0.0560
LOG(GNP)	0.395191	0.181641	2.175663	0.0359
LOG(M)	-0.069098	0.100743	-0.685887	0.4969
LOG(DPM(-1))	0.900407	0.061830	14.56254	0.0000
R-squared	0.992735	Mean dependent var		3.284129
Adjusted R-squared	0.992161	S.D. dependent var		1.433476
S.E. of regression	0.126914	Akaike info criterion		-1.200224
Sum squared resid	0.612071	Schwarz criterion		-1.034732
Log likelihood	29.20470	F-statistic		1730.847
Durbin-Watson stat	1.653355	Prob(F-statistic)		0.000000

Equation: DPXEQ  
 Dependent Variable: LOG(DPX)  
 Method: Least Squares  
 Date: 12/02/98 Time: 20:26  
 Sample(adjusted): 1956 1997  
 Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.984595	1.925592	-2.069283	0.0454
LOG(GNP(-1))	0.358542	0.165317	2.168814	0.0364
LOG(X)	-0.015404	0.109962	-0.140082	0.8893
LOG(DPX(-1))	0.883492	0.068465	12.90430	0.0000
R-squared	0.993174	Mean dependent var	3.337342	
Adjusted R-squared	0.992635	S.D. dependent var	1.400428	
S.E. of regression	0.120185	Akaike info criterion	-1.309171	
Sum squared resid	0.548892	Schwarz criterion	-1.143678	
Log likelihood	31.49258	F-statistic	1842.919	
Durbin-Watson stat	1.747809	Prob(F-statistic)	0.000000	

Equation: LANDEQ  
 Dependent Variable: LAND  
 Method: Least Squares  
 Date: 10/13/98 Time: 20:04  
 Sample(adjusted): 1957 1996  
 Included observations: 40 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1369.948	467.5543	2.930029	0.0059
WLAGRI/(CPI/100)	-9.774589	10.59036	-0.922971	0.3623
VAR	0.025674	0.010611	2.419690	0.0209
POPT	-0.038148	0.019984	-1.908936	0.0645
LAND(-1)	0.794756	0.094705	8.391933	0.0000
R-squared	0.981743	Mean dependent var	10705.47	
Adjusted R-squared	0.979657	S.D. dependent var	2239.757	
S.E. of regression	319.4555	Akaike info criterion	14.48758	
Sum squared resid	3571814.	Schwarz criterion	14.69869	
Log likelihood	-284.7516	F-statistic	470.5258	
Durbin-Watson stat	2.133294	Prob(F-statistic)	0.000000	

Equation: MSEQ  
 Dependent Variable: LOG(MS)  
 Method: Least Squares  
 Date: 12/02/98 Time: 14:40  
 Sample(adjusted): 1968 1997  
 Included observations: 30 after adjusting endpoints  
 Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.71057	3.900436	3.515139	0.0016
NDA+NFA	4.50E-06	1.92E-06	2.350668	0.0263
AR(1)	0.973122	0.022868	42.55310	0.0000
R-squared	0.997248	Mean dependent var		10.29018
Adjusted R-squared	0.997044	S.D. dependent var		1.266479
S.E. of regression	0.068855	Akaike info criterion		-2.418980
Sum squared resid	0.128008	Schwarz criterion		-2.278860
Log likelihood	39.28470	F-statistic		4892.068
Durbin-Watson stat	2.341256	Prob(F-statistic)		0.000000
Inverted AR Roots	.97			

Equation: TBILLEQ  
 Dependent Variable: LOG(TBILL)  
 Method: Least Squares  
 Date: 10/13/98 Time: 20:12  
 Sample(adjusted): 1970 1997  
 Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.717259	1.699930	-2.186713	0.0402
LOG(GNP)	1.630572	0.288254	5.656715	0.0000
LOG(MS/(PGNP1/100))	-1.418804	0.288248	-4.922157	0.0001
D6972	0.482962	0.117627	4.105884	0.0005
D8385	0.365078	0.095960	3.804499	0.0010
D8588	-0.197867	0.089482	-2.211261	0.0382
D8891	0.310529	0.075392	4.118878	0.0005
R-squared	0.861183	Mean dependent var		2.625024
Adjusted R-squared	0.821521	S.D. dependent var		0.298286
S.E. of regression	0.126016	Akaike info criterion		-1.092495
Sum squared resid	0.333482	Schwarz criterion		-0.759444
Log likelihood	22.29493	F-statistic		21.71302
Durbin-Watson stat	1.508611	Prob(F-statistic)		0.000000

Equation: XEQ

Dependent Variable: LOG(X)

Method: Least Squares

Date: 12/01/98 Time: 09:34

Sample(adjusted): 1956 1997

Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.845338	1.324120	-0.638415	0.5270
LOG(GNP)	1.048304	0.108994	9.617993	0.0000
LOG(ER*DEXPI)	0.029093	0.049455	0.588287	0.5598
LOG(X(-1)/GNP(-1))	0.874990	0.082394	10.61957	0.0000
R-squared	0.983888	Mean dependent var	11.54536	
Adjusted R-squared	0.982616	S.D. dependent var	0.735058	
S.E. of regression	0.096916	Akaike info criterion	-1.739555	
Sum squared resid	0.356922	Schwarz criterion	-1.574063	
Log likelihood	40.53066	F-statistic	773.5036	
Durbin-Watson stat	1.803271	Prob(F-statistic)	0.000000	

Equation: MEQ

Dependent Variable: LOG(M)

Method: Least Squares

Date: 10/27/98 Time: 10:27

Sample(adjusted): 1956 1997

Included observations: 42 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.362976	1.789584	-1.320405	0.1946
LOG(GNP)	0.253461	0.160026	1.583875	0.1215
LOG(ER*DMPI)	-0.032356	0.046819	-0.691084	0.4937
LOG(M(-1))	0.928967	0.076456	12.15034	0.0000
R-squared	0.982650	Mean dependent var	11.70137	
Adjusted R-squared	0.981280	S.D. dependent var	0.724966	
S.E. of regression	0.099191	Akaike info criterion	-1.693147	
Sum squared resid	0.373876	Schwarz criterion	-1.527654	
Log likelihood	39.55608	F-statistic	717.3841	
Durbin-Watson stat	1.363843	Prob(F-statistic)	0.000000	

Equation: OTHTRDEQ

Dependent Variable: OTHTRD

Method: Least Squares

Date: 12/02/98 Time: 14:06

Sample(adjusted): 1957 1997

Included observations: 41 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-270.1311	144.2814	-1.872252	0.0693
XD	-0.406452	0.191264	-2.125088	0.0405
MD	0.521605	0.130647	3.992486	0.0003
CURBAL(-1)	0.442898	0.120261	3.682821	0.0008
D8996	342.9223	331.0762	1.035781	0.3072
R-squared	0.923612	Mean dependent var		1025.732
Adjusted R-squared	0.915125	S.D. dependent var		2042.352
S.E. of regression	595.0049	Akaike info criterion		15.72887
Sum squared resid	12745111	Schwarz criterion		15.93784
Log likelihood	-317.4417	F-statistic		108.8203
Durbin-Watson stat	1.453965	Prob(F-statistic)		0.000000

**DEMOGRAPHIC SUBMODEL: Estimated Behavioral Equations**

Equation: RURALHH

Dependent Variable: LOG(PROHR)

Method: Least Squares

Date: 09/12/98 Time: 15:28

Sample(adjusted): 1959 1997

Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012685	0.014580	0.870011	0.3902
LOG(EMG/EMP)	0.087754	0.034124	2.571656	0.0145
LOG(PROHR(-1))	1.608441	0.120943	13.29918	0.0000
LOG(PROHR(-2))	-0.703057	0.122302	-5.748511	0.0000
R-squared	0.984979	Mean dependent var	-0.466278	
Adjusted R-squared	0.983692	S.D. dependent var	0.113150	
S.E. of regression	0.014450	Akaike info criterion	-5.539373	
Sum squared resid	0.007308	Schwarz criterion	-5.368751	
Log likelihood	112.0178	F-statistic	765.0341	
Durbin-Watson stat	1.983329	Prob(F-statistic)	0.000000	

Equation: INFAMORT

Dependent Variable: LOG(INFANM)

Method: Least Squares

Date: 12/02/98 Time: 14:53

Sample(adjusted): 1958 1997

Included observations: 40 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.726182	0.835060	3.264654	0.0025
FODR(-1)/POPT(-1)	-0.076062	0.054139	-1.404949	0.1691
HPCAP(-1)	-0.204184	0.481148	-0.424369	0.6740
GNP/POPT	-0.048622	0.014905	-3.262210	0.0025
PROHR	1.068014	0.280627	3.805819	0.0006
LOG(INFANM(-1))	0.406175	0.143152	2.837373	0.0076
R-squared	0.977327	Mean dependent var	4.334135	
Adjusted R-squared	0.973993	S.D. dependent var	0.289759	
S.E. of regression	0.046729	Akaike info criterion	-3.151431	
Sum squared resid	0.074242	Schwarz criterion	-2.898099	
Log likelihood	69.02862	F-statistic	293.1149	
Durbin-Watson stat	1.789290	Prob(F-statistic)	0.000000	



Equation: ASFR15EQ  
 Dependent Variable: LOG(ASFR15)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:14  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.803389	0.182453	20.84583	0.0000
PCMA15	-2.926700	1.753907	-1.668674	0.1044
D7380	-0.209257	0.052949	-3.952049	0.0004
INFANM	0.007667	0.000930	8.245468	0.0000
R-squared	0.758016	Mean dependent var	4.018340	
Adjusted R-squared	0.736664	S.D. dependent var	0.217781	
S.E. of regression	0.111757	Akaike info criterion	-1.445682	
Sum squared resid	0.424646	Schwarz criterion	-1.273305	
Log likelihood	31.46797	F-statistic	35.50167	
Durbin-Watson stat	0.708251	Prob(F-statistic)	0.000000	

Equation: ASFR20EQ  
 Dependent Variable: LOG(ASFR20)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:14  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.799509	0.094231	50.93350	0.0000
PCMA20	0.534390	0.244539	2.185298	0.0359
D7380	-0.062669	0.017450	-3.591254	0.0010
INFANM	0.004264	0.000461	9.257867	0.0000
R-squared	0.886847	Mean dependent var	5.373853	
Adjusted R-squared	0.876863	S.D. dependent var	0.116123	
S.E. of regression	0.040749	Akaike info criterion	-3.463481	
Sum squared resid	0.056456	Schwarz criterion	-3.291103	
Log likelihood	69.80613	F-statistic	88.82586	
Durbin-Watson stat	0.675759	Prob(F-statistic)	0.000000	

Equation: ASFR25EQ  
 Dependent Variable: LOG(ASFR25)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:14  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.343552	0.332858	13.04927	0.0000
PCMA25	1.368259	0.400210	3.418850	0.0016
PEC25	-0.006058	0.005410	-1.119778	0.2707
INFANM	0.003422	0.000884	3.870391	0.0005
R-squared	0.928642	Mean dependent var		5.557812
Adjusted R-squared	0.922346	S.D. dependent var		0.133802
S.E. of regression	0.037286	Akaike info criterion		-3.641102
Sum squared resid	0.047268	Schwarz criterion		-3.468725
Log likelihood	73.18095	F-statistic		147.4907
Durbin-Watson stat	0.330749	Prob(F-statistic)		0.000000

Equation: ASFR30EQ  
 Dependent Variable: LOG(ASFR30)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:15  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.857505	0.696595	1.230994	0.2268
PCMA30	5.184345	0.856939	6.049842	0.0000
PEC25	-0.010308	0.004891	-2.107749	0.0425
INFANM	0.004303	0.000931	4.622463	0.0001
R-squared	0.961606	Mean dependent var		5.446071
Adjusted R-squared	0.958219	S.D. dependent var		0.175539
S.E. of regression	0.035881	Akaike info criterion		-3.717911
Sum squared resid	0.043773	Schwarz criterion		-3.545533
Log likelihood	74.64030	F-statistic		283.8532
Durbin-Watson stat	0.414023	Prob(F-statistic)		0.000000

Equation: ASFR35EQ  
 Dependent Variable: LOG(ASFR35)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:15  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.284019	1.549196	-4.056310	0.0003
PCMA35	12.91181	1.869600	6.906188	0.0000
PEC25	-0.019629	0.007524	-2.608896	0.0134
INFANM	0.005365	0.001361	3.941200	0.0004
R-squared	0.950806	Mean dependent var	5.131541	
Adjusted R-squared	0.946466	S.D. dependent var	0.219833	
S.E. of regression	0.050864	Akaike info criterion	-3.020031	
Sum squared resid	0.087962	Schwarz criterion	-2.847653	
Log likelihood	61.38059	F-statistic	219.0479	
Durbin-Watson stat	0.386913	Prob(F-statistic)	0.000000	

Equation: ASFR40EQ  
 Dependent Variable: LOG(ASFR40)  
 Method: Least Squares  
 Date: 01/22/99 Time: 18:15  
 Sample(adjusted): 1960 1997  
 Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.845275	2.096637	-2.310975	0.0270
PCMA40	9.839492	2.653573	3.708017	0.0007
PEC25	-0.013691	0.016824	-0.813802	0.4214
INFANM	0.012951	0.002499	5.182327	0.0000
R-squared	0.895679	Mean dependent var	4.398973	
Adjusted R-squared	0.886474	S.D. dependent var	0.291219	
S.E. of regression	0.098122	Akaike info criterion	-1.705904	
Sum squared resid	0.327352	Schwarz criterion	-1.533526	
Log likelihood	36.41217	F-statistic	97.30536	
Durbin-Watson stat	0.530877	Prob(F-statistic)	0.000000	

Equation: ASFR45EQ

Dependent Variable: ASFR45

Method: Least Squares

Date: 01/24/99 Time: 17:37

Sample(adjusted): 1960 1997

Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-160.1058	46.71466	-3.427314	0.0016
PCMA45	205.0753	62.19465	3.297314	0.0023
PEC25	-0.579122	0.438451	-1.320839	0.1954
INFANM	0.195882	0.063728	3.073743	0.0041
R-squared	0.819885	Mean dependent var		17.90200
Adjusted R-squared	0.803992	S.D. dependent var		5.536204
S.E. of regression	2.451031	Akaike info criterion		4.730195
Sum squared resid	204.2569	Schwarz criterion		4.902573
Log likelihood	-85.87371	F-statistic		51.58930
Durbin-Watson stat	0.514435	Prob(F-statistic)		0.000000

### Annex C

#### Basic Simulation Results

YEAR	Total Fertility	GNP Capita	Savings per Capita	Investment/ Capita	Full-Time Unemp.Rate	5-yr GNP	% of Agri Employment	VAR/GDP	Infant Mortality Rate
	Rate					Growth Rate			
1995	4.22	11853.07	1674.64	2691.29	39.97		44.06	21.55	49
2000	3.92	13713.21	3034.04	4643.54	30.47	5.14	41.38	20.10	43
2005	3.74	15946.82	4351.99	7616.15	23.49	5.38	40.22	18.95	35
2010	3.56	18674.93	6099.97	12788.09	18.70	5.45	39.73	18.01	27
2015	3.36	22755.03	9014.22	22135.07	15.07	6.18	39.46	16.97	19
2020	3.17	28889.40	13897.84	39160.40	11.20	6.89	39.33	15.80	11
2025	3.03	37017.30	21177.49	70269.09	9.27	6.93	39.25	14.65	6