NATIONAL RECONSTRUCTION AND DEVELOPMENT MODEL OF LEBANON

by

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ABSTRACT

Summary

This paper describes a pilot model, NRDM-2, developed through research conducted at the American University of Beirut sponsored by the Lebanese Government, the harbinger of a package of interactive national, regional, and sectoral models to be used to guide reconstruction and development in Lebanon.

Background

Whereas the immediate obligation of Government after Lebanon's 1975-76 Civil War was to provide emergency relief, it was recognized that national planning was essential if the problems of reconstruction and development were to be solved. The Council for Development and Reconstruction (CDR) was established with one of its responsibilities being to prepare a plan that would chart Lebanon's future. In 1977 the CDR began laying the ground-work for development planning by commissioning a series of Agenda Papers on the various sectors of the Lebanese economy and on specific topics of vital importance to strategic planning.

In November 1979 an interdisciplinary group of faculty at the American University of Beirut (AUB) prepared a proposal, "A Systems Approach to Guiding Reconstruction and Development in Lebanon," that outlines a procedure for using System Dynamics models to generate development scenarios for Lebanon as aids for national, regional and sectoral planning. The CDR formally endorsed the AUB proposal and the two organizations decided to involve teams of graduate students and their advisors, first in the development of, and then in experimentation with, a pilot model which would serve both as a training laboratory for them and as a benchmark for future research. The first team was formed in April 1980 and NRDM-1 was the result. The next team was formed at that time and the expanded version of the pilot model, referred to as NRDM-2, is now operational.

Description of NRDM-2

NRDM-2 is structured to accommodate three development orientations: 1) resource development, 2) regional development, and 3) sectoral development. Resource components include natural resources, land resources, water resources, and human resources (manpower). Regional development is organized on the basis of rural and urban in NRDM-2.

Sectors represented in the model are agriculture, manufacturing, business, infrastructure and government. Obviously, the three orientations overlap. They are also tied together by two quantities most responsible for material growth: 1) population-including the effects of all economic and environmental factors that influence human birth, death, and migration rates, and 2) capital-including the means of producing industrial, service, and agricultural outputs. For the purpose of this paper, NRDM-2 is organized as follows:

- Manufacturing (Eqs. 1-36)
- Business (Eqs. 37-69)
- Infrastructure (Eqs. 70-105)
- Manpower (Eqs. 106-137)
- Government Service (Eqs. 138-171)
- Agriculture (Eqs. 172-217)
- Population (Eqs. 218-244)
- Utilities (Eqs. 245-254)
- Highways (Eqs. 255-261)
- Housing (Eqs. 262-277)
- Trade-Energy (Eqs. 278-292)
- Socio-Economic Indications (Eqs. 293-306)

These 12 model components correspond to the elements defined by the three rows and four columns in the accompanying causal diagram.

Uses of the Model

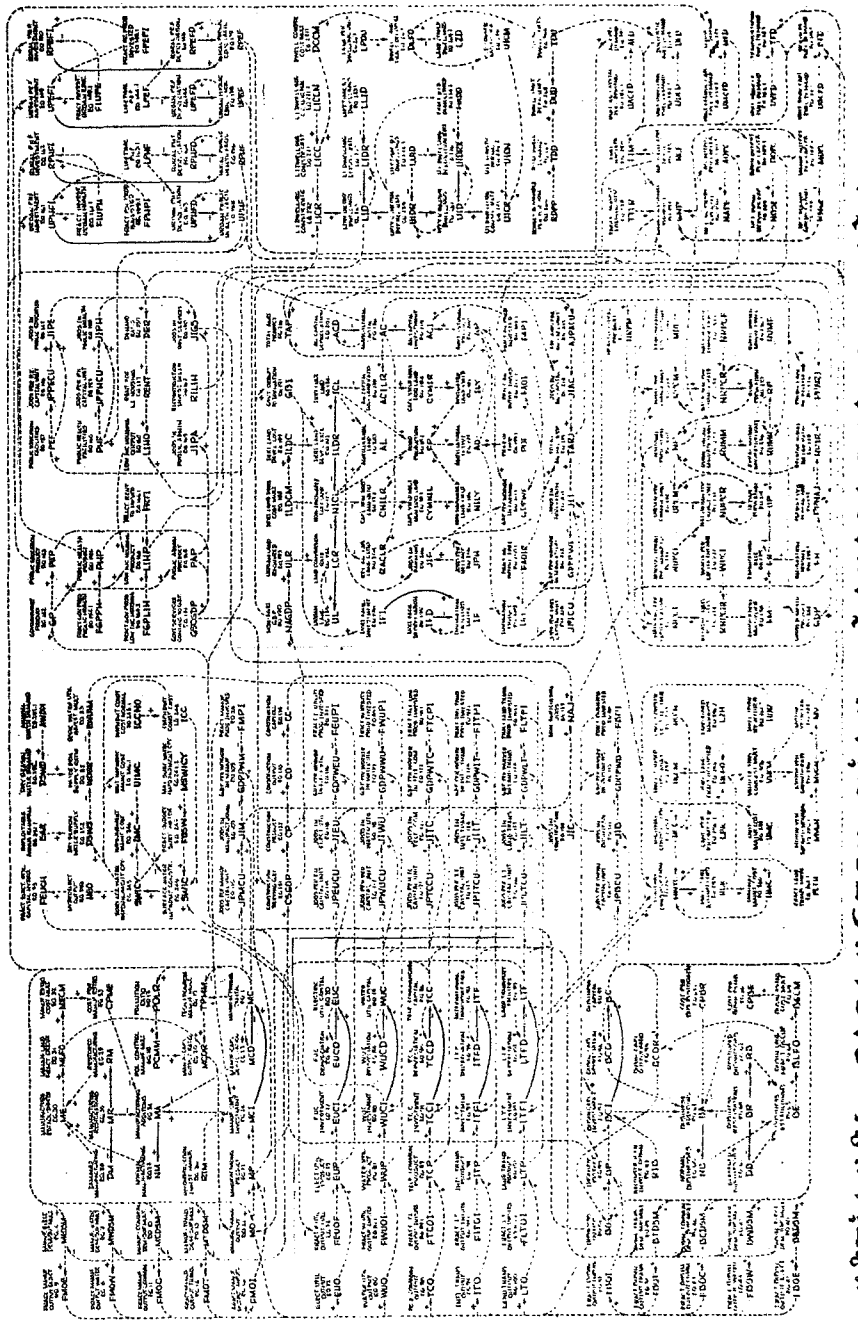
The structural and parametric assumptions inherent in NRDM-2 were distilled from the series of Agenda Papers obtained by the Council of Development and Reconstruction from many sources both in and out of Lebanese Government. Like NRDM-2, the Agenda Papers, taken collectively, is a model of Lebanon. Each of the Agenda Papers deal with goals involving certain variables and policy interventions involving other variables. To link the goal and policy variables, the authors of the Agenda Papers have implied an understanding of a complex set of intervening relationships, a system. Since the prose of the reports is the model representing the system, the Agenda Papers may be thought of as a verbal model . In contrast, the complex set of intervening relationships between variables in NRDM-2 are expressed by equations and it is referred to as a mathematical model . The verbal model of Lebanon contained in hundreds of pages of Agenda Papers spanning many disciplines can not promote communication and understanding leading to consensus and it is too fuzzy, static, incomplete and imprecise to be used for decision making. Thus, in the briefings, seminars and workshops that evolved in the modeling, system dynamics has become the language of communication.

The objective aspects of Lebanon's development are contained in the relationships between the variables. Using the values of the 435 parameters for 1980, the model calculates the values of the variables at consecutive years over a fifty year period. The subjective aspects of Lebanon's development are dealt with in the way the model is used

to generate scenarios. Four basic scenarios investigated are the following: 1) The "No-War" Reference Scenario, 2) The No Reconciliation - No Reconstruction Scenario, 3) The Reconstruction Without Reconciliation Scenario, and 4) The Reconstruction With Reconciliation Scenario. By "No-War" Reference Scenario we mean what could have been expected in Lebanon over the period 1980-2030 if the 1975-76 Civil War had not happened. The term "Reconciliation" refers to the restoration of the government's authority as opposed to the continuation of the present condition of neither peace nor war, but one of tension, intimidation, terror, violence and sporadic liquidations, fostered by militias and armed groups. "Reconstruction" refers to a plan unveiled by the CDR in 1979 that has been incorporated into NRDM-2. Private sector needs are reckoned at LL 9 billion (LL=$.25), LL .8 billion per year for five years starting in 1980 to manufacturing and LL 1.0 billion per year for five years starting in 1980 to business. It includes LL 10 billion over five years in the public sector spread among telecommunications, ports and airports, highways, and low income housing.

Conclusions

Lebanon is faced with the challenges of national reconstruction, development, and reconciliation. The response to each is a search for funds, a search for facts, and a search for compromise, respectively. The premise upon which this study is based is that reconstruction, development, and reconciliation are not separate technological, economic, and political problems, but that reconstruction and reconciliation are aspects of a single development metaproblem, interpreted in its broadest sense. Funds, facts and compromise are necessary conditions for Lebanon's development; they are not sufficient conditions. Investing funds without impact-sensitive plans, amassing data unsupported by theories, and negotiating in the absence of precise communication can only provide illusions of progress. Overcoming physical deficiencies through reconstruction and reducing the institutional deficiencies as part of reconciliation can both be aided by eleminating the conceptual deficiencies inherent in the traditional approaches to development planning.



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THE SITUATION

> A certain hunter... came one day upon a cave in the mountains, where he found a hollow full of bees' honey. So he took somewhat thereof and carried it to the city, followed by a hunting dog which was dear to him. He stopped at the shop of an oilman and offered him the honey for sale... As he emptied it that he might see it, a drop fell to the ground, whereon flies flocked to it and a bird swooped down upon the flies... Now the oilman had a cat, which pounced upon the bird, and the hunter's dog sprang upon the cat and killed it; whereupon the oilman ran at the dog and killed it and the hunter in turn sprang upon the oilman and killed him... Now the oilman was of one village and the hunter of another; and when the people of the two villages heard what had passed, they took arms and rose on one another in anger, and the sword continued to play amongst them until many of the people died... None knows their number, save God Almighty.
>
> Arabian Nights, Night 528

1.1. Introduction

Lebanon, the country is new; Lebanese society is ancient. Lebanon's current geographic frontiers and political institutions were defined in the Constitution of 1926 and, except for slight modifications introduced on the eve of Lebanon's independence in 1943, remain in effect. The social and cultural characteristics of Lebanese society have their origins in the Phoenician, Greco-Roman, Arab, and Ottoman civilizations. The Lebanese state, with an area of ten thousand square kilometers, and Lebanese society, with a resident population of three million persons (and almost an equal number of expatriates), have a significance in the Middle East and, indeed worldwide, out of proportion to their size, owing to their role as a vital link between East and West.

For half a century of statehood, from 1926 to 1975, Lebanon prospered. Lebanon became the banking and commercial center of the Middle East, providing services with an efficiency rare in the developing world. Fine restaurants and hotels welcomed international tourists and businessmen.

The country's per capita income, literacy rate, and health standards were among the highest in Afro-Asia. Even its democracy, based on a confessional formula in which the president was a Maronite Christian, the prime minister was a Sunni Moslem, and the chamber would consist of 56 Christians and 43 Moslems, seemed to work even though bearing increasingly less resemblance to the religious composition of the population.

Then in April 1975, a massacre of Palestinian refugees escalated into a civil war, a conflict between Maronites and Moslems, Maronites and other Christians, between right and left ideologies, and between the urban establishment and peasant immigrants. In 1976, Syrian forces invaded the country in order to control the conflict and later became ligitimized as the Arab Deterrent Force. After a massive invasion of the south in 1978 by the Israeli army, a United Nations peace keeping force was stationed in the south. Thus, seemingly without warning, the liberal, democratic, pluralistic edifice of Lebanon was shattered.

Explanations for the sudden reversal of fortunes in Lebanon abound. They range from external conspiracy accusations placing the blame on regional and international forces beyond Lebanon's control to revelations of ideological and religions contradictions inherent in the system.

1.2. Civil Strife and Anarchy

The result of the chaos of the last five years has left 75,000 dead and 10,000 physically wounded. The commercial, economic, and social life of Lebanese society exists in the shadow of violence and political uncertainty. Real and potential financial losses to the year 1980 by the Beirut Chamber of Commerce and Industry's tabulation is placed at 21 billion L.L. In terms of psychological effects on the Lebanese people, the post war years have been

even more devastating than the two years of war. Lastly, and most disturbing of all, the current state of anarchy is becoming an accepted way of life.

Today there is not one Lebanon, nor even two, but a land divided into many zones of influence. The area from East Beirut north to Tripoli is dominated by the Falangist Party. From West Beirut south to the Litani River the Palestine Liberation Organization and its Lebanese leftist allies exert control. In Ras Beirut itself a conglomerate of parties friendly to Syria and to the PLO wields authority. South of the Litani River are two zones: a narrow one along the border with Isreal is held by a force of Christian irregulars led by Major Saad Haddad. The area between this narrow strip and the Palestinians is inhabited largely by Shiite Moslems and protected by United Nations' troops. Southeast of Beirut, the Druze leader Walid Junblat, head of the Progressive Socialist, exercises influence within limits. The northern and western parts of the country are held by the Syrian Army which has remained since 1976.

In order to govern, the elected Lebanese administration must work with the Syrians, the Palestinians, the Falangists, UMIFIL, and dozens of other organizations. To further complicate things, many of these forces represent other national interests--Iraq, Iran, Saudi Arabia, Israel, as well as the United States and the Soviet Union.

1.3. Political Alternatives

The most serious impediment to sustained economic recovery and social development is the government's inability to restore its full authority. It appears that three alternatives face Lebanon: (1) perpetuation of the current situation, (2) partition of the country into two or more states, and (3) national reconciliation. The first option means the continuation of a condition of neither peace nor war, but one of tension, intimidation, terror,

violence and sporadic liquidations. Most Lebanese obviously oppose this, but they acquiesce. The absence of an effective central government forces them to rally to militias and armed groups.

The partition option has been strengthened by the political, economic and demographic developments created by the war and by the entrenched positions of the ideologically conflicting groups. This option of course has many variations depending upon the number of states formed and their boundaries. For example, one possibility would be the division of Lebanon into two states, one dominated by Maronites, and the other by Muslims. This would create problems for Christian minorities both within the new Maronite state and throughout the Middle East. The new Arab state could not satisfy both the radical socialist parties that have developed among the Lebanese Muslims and the national aspirations of the Palestinians who now live in Lebanon. The formation of three states so as to give the Palestinians a homeland and the national identity they are fighting for would rob Lebanese Muslims--Sunnis, Shiites and Druze alike--of a substantial portion of the political and economic power they now possess. It is doubtful that both Syria and Israel would agree to the same partition formula even if the fractions within Lebanon could.

The preferred option is to build a united, independent Lebanon. The obstacles to developing a formula for accommodating the interests of all the rival factions engaged in the present division of the country are formidable, indeed. The greatest asset that Lebanon possesses in overcoming these obstacles is its unique heritage as a melting pot of civilizations and, due to the diversity of its sects, a free field for the meeting place of ideas and beliefs in the exercise of tolerance, esteem, and progress.

THE APPROACH

> Beyond Ghor there was a city. All its inhabitants were blind. A king with his entourage arrived nearby and with his army camped in the desert. He had a mighty elephant, which he used in attack and to increase the people's awe... The populace became anxious to learn about the elephant, and some among this blind community ran to find it. Since they did not know even the form or shape of the elephant, they groped slightlessly, gathering information by touching some part of it. Each thought that he knew something because he could feel a part... When they returned to their fellow-citizens, eager groups clustered around them, anxious, misguidedly, to learn the truth from those who were themselves astray. They asked about the form, the shape, and the size of the elephant, and they listened to all they were told... The man whose hand had reached an ear said, "It is a large, rough thing, wide and broad like a rug"... One who had felt the trunk said: "I have the real facts about it. It is like a straight and hollow pipe, awful and destructive". One who had felt its feet and legs said: "It is mighty and firm, like a pillar"... Each had felt one part out of many. Each had perceived the whole, wrongly.
>
> Tales of the Dervishes.

2.1. Picking up the Pieces

Rebuilding after any war is a long and difficult undertaking. It is even more difficult when there is political uncertainty and physical insecurity. The first obligation of the Government was to provide emergency relief--feed those who were hungry, find temporary housing for the dispossessed, and treat the many who were sick and injured. As a massive emergency efforts ended, emphasis turned from problems of relief and rehabitation to reconstruction and development.

Governmental response to the consequences of the 1975-76 war has taken two main forms: (1) an attempt to help settle various immediate economic issues such as creditor-debtor relationships and the provision of some funds for reconstruction purposes in the private sector, and (2) the establishment of the institutional framework considered necessary for future

socio-economic planning. Recognizing the long-range importance of the latter--forward planning--the Government quickly established its Council for Development and Reconstruction (CDR) in late January 1977, even before full scale relief efforts were underway. The responsibilities given the Council were extensive, but ranking above all others was the obligation to prepare an overall, comprehensive development plan that would chart the direction, scope, and composition of Lebanon's future.

2.2. The Agenda Papers

The CDR approached its post-war development planning task by commissioning a series of "Agenda Papers" on the various sectors of the Lebanese economy, and on specific topics of vital importance to strategic planning. Suggested Agenda Paper topics included the following: housing, telecommunications, transport, roads, potable water, Beirut city center, airport, seaport, agriculture, education, health, tourism, industry, repatriation of skills and capital, role of private sector, rural-urban balance, incomes policy, fiscal reform, delivery of social services, administrative reform, culture, energy, manpower, and the transfer of science and technology. The purposes, as expressed in an advisor's memorandum, were as follows: "They will form the framework for a position paper on the Government's planning objectives to be submitted to the Council of Ministers in June, 1978; they will provide a basis for systematic and more detailed studies; and they will assess, after discussions with representative groups the degree of consensus on policy goals".

The Agenda Papers were prepared and submitted to the CDR. The CDR had reason to be grateful for the serious effort put into most of the papers without compensation for the authors. However, while each author has presented a faithful perception of a part of the system we call Lebanon, the

overall picture formed is as misleading as the blindmen of Ghor's description of the elephant. Since the approach to development planning exemplified is not an illogical approach, not even an uncommon one for that matter, the metaphor is less a criticism of the CDR than it is an indictment of the development planning state of the art. What is needed is a way to synthesize many isolated, incomplete perceptions of national development into a complete picture.

2.3. Systems Approach

The reconstruction and development of Lebanon requires some form of "systems" approach. Even for simple interventions associated with small projects, the factors that will determine the outcome must be identified, their relationships must be established, and secondary effects anticipated. In Lebanon we are talking about a massive intervention of very large projects with consequences that can easily be overlooked because they are incidental to the projects themselves. The unfortunate experiences of the United States with low income housing and highway programs, and of many countries with irrigation projects and multi purpose dams are familiar examples. Systemic thought is needed.

In November 1979 an interdisciplinary group of faculty of the American University of Beirut (AUB) prepared a proposal, "A Systems Approach to Guiding Reconstruction and Development in Lebanon," that outlines a procedure for using computer simulation models to generate development scenarios for Lebanon as aids for national, regional and sectoral planning. The CDR has formally endorsed the AUB proposal and the two organizations are working together at the administrative level to obtain funding for this comprehensive modeling effort. While there is optimism that the necessary external support is forthcoming, it was recognized that the development of a

dynamic computer-based planning and decision-aiding instrumentality could not be deferred indefinitely in anticipation of donor funding. It was decided to involve teams of students, first in the development of, and then in the experimentation with, a pilot model which would serve both as a training laboratory for them and a benchmark for future research.

2.4. Research Contract

In the summer of 1980 on agreement was entered into whereby the Republic of Lebanon, acting through the CDR, would grant AUB a sum previously granted to the CDR by the U.S. Agency for International Development, to develop a pilot model, the harbinger of a proposed package of interactive national, regional, and sectoral computer models to be used for the reconstruction and rehabilitation of Lebanon. The following main guidelines set forth the overall plan of action agreed upon by the parties:

Phase 1: The development of NRDM (National Reconstruction and Development Model), an operational computerized simulation model of Lebanon.

Phase 2: The performance of sensitivity analysis and calibration of parameters for three basic scenarios, identified as follows: (1) the "no War" Scenario, (2) the "Reconstruction Plan" Scenario, and (3) the "No Reconstruction Plan" Scenario.

Phase 3: The preparation of the final report completely documenting the pilot model NRDM to serve as a training manual for CDR personnel and AUB students.

The calendar of program implementation was to be of a flexible nature with the general strategy, taken from the Grant's terms of reference, to include the following steps:

Phase 1: Ending February 1981. The implementation of NRDM on the American University of Beirut IBM 370 Computer and the training of six AUB students in the use of the model who will be available to the CDR for hiring upon their graduation.

Phase 2: Ending May 1981. The training of an additional 6 to 12 students in the use of the model. These students will be graduate students who will use this project in partial fulfillment of their degree requirements at AUB.

Phase 3: Ending August 1981. The complete documentation of the model in a final report which can serve us a training manual for CDR personnel and AUB students interested in extending their research.

Seven students worked on Phase 1, the first version of the pilot model which came to be referred to as NRDM-1. Under Phase 2 it was possible not only to perform sensitivity and policy analyses but to extend the model, and this improved version is called NRDM-2. Twelve students participated on this phase in partial fulfillment of Master Degrees. Phase 3 is the Final Report which is summarized in this paper.

THE MODEL

> He himself, Hermes said, would give Perseus a sword to attack Medusa with, which could not be broken by the Gorgon's scales. This was a wonderful gift and yet, thought Perseus to himself, what use was a sword when the creature to be stuck by it could turn the swordsman into stone before he was within stricking distance. Then Athena took off the shield of polished bronze that covered her breast and held it out to him. "Look into this when you attack her", she said, "and you will be able to see her reflection, and so avoid her deadly power". With these, Perseus sped to the hall of the Gorgons. In silence set two of the sisters,--"
>
> "But a third woman paced about the hall
> And ever turned her head from wall to wall
> And moaned aloud, and shreiked in her despair;
> Because the golden tresses of her hair
> Were moved by writhing snakes from side to side,
> That in their writhing oftentimes would glide
> On to her breast, or shuddering shoulders white;
> Or, falling down, the hideous things would light
> Upon her feet, and crawling then would twine
> Their slimy folds about her ankles fine.
>
> This was Medusa.
>
> The Classic Myths

3.1. Need for a Model

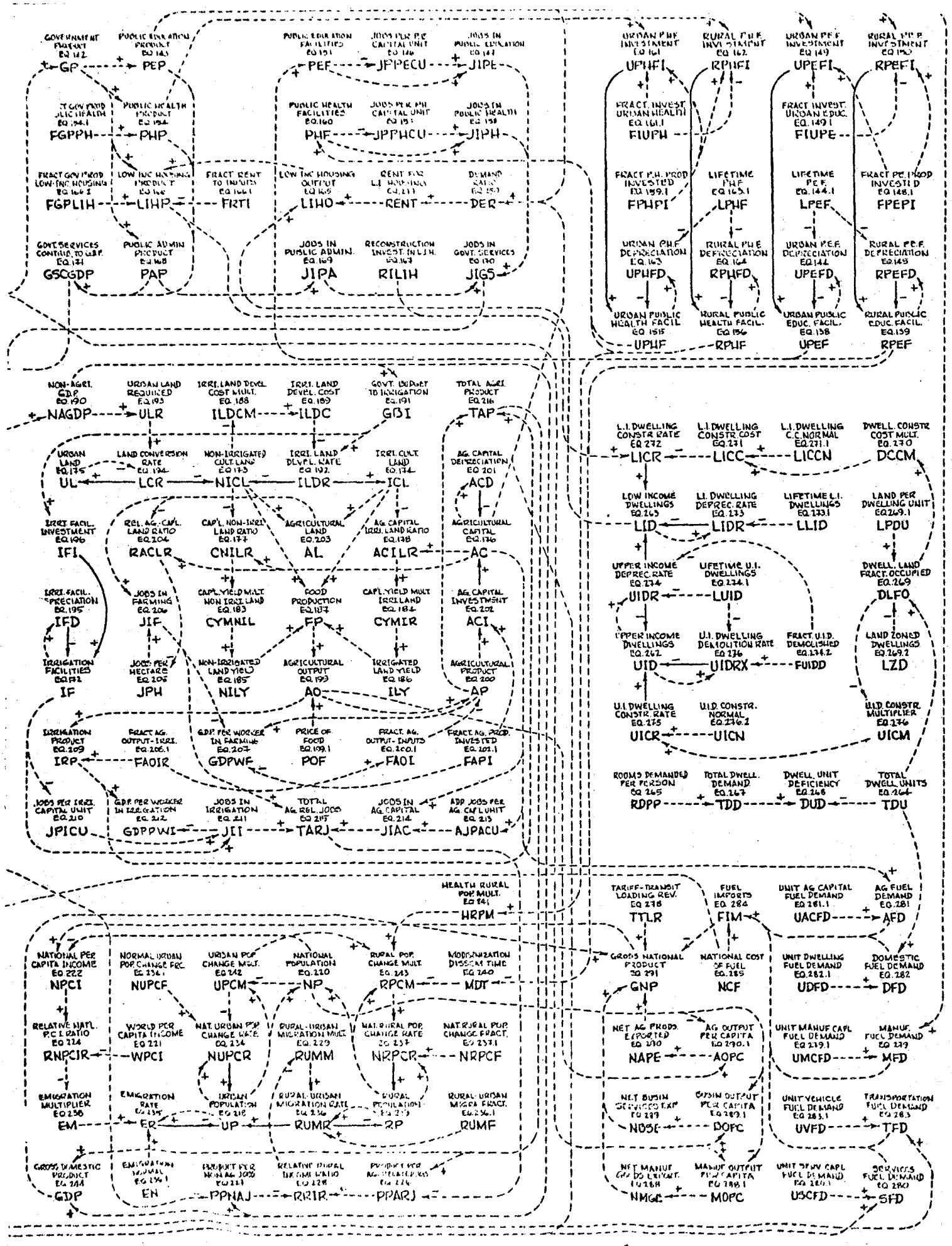
Richard Mason described mankind's pressing problems as possessing a Medusan quality about them. This certainly applies to Lebanon's which are difficult to formulate, dangerous to embrace, and paralyzing to confront. Policy makers are, understandably, reluctant to face the issues head-on. They, as modern day Perseuses, also need shields. Models that cast realistic images of the real world can serve as those shields. A system dynamics model of Lebanon that can be used for guiding reconstruction and development will be described in this section.

3.2. Forms of the Model

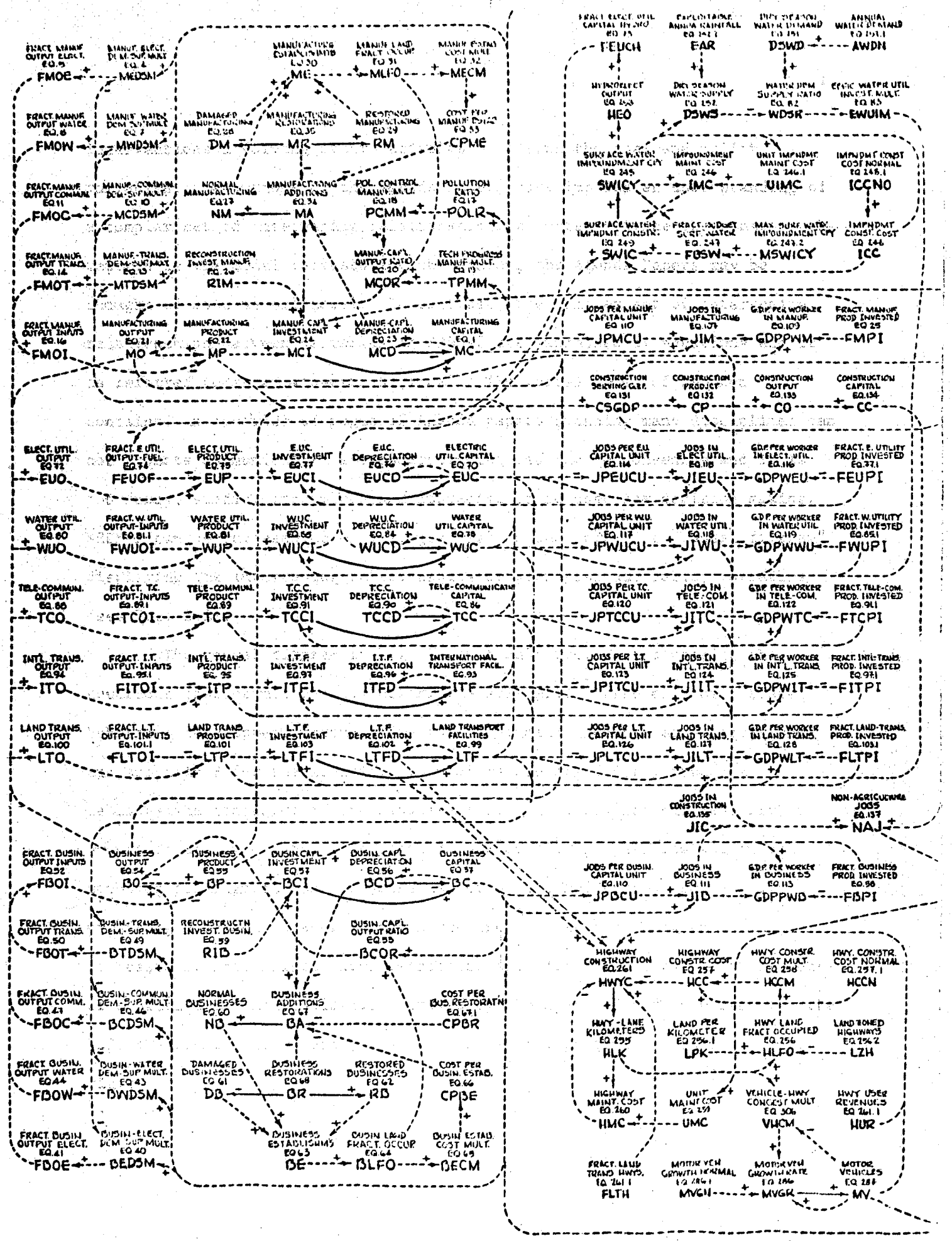
NRDM-2 is a model of Lebanon. It was distilled from the Agenda Papers which, taken collectively, is also a model of Lebanon. Each of the Agenda Papers deal with goals involving certain variables and policy

interventions involving other variables. To link the goal and policy variables, the authors of the Agenda Papers have implied an understanding of a complex set of intervening relationships, a system. Since the prose of the reports is the model representing the system, the Agenda Papers may be thought of as a verbal model. In contrast, the complex set of intervening relationships between variables in NRDM-2 are expressed by equations and it is referred to as a mathematical model. The verbal model of Lebanon contained in hundreds of pages of Agenda papers spanning many disciplines can not promote communication and understanding leading to consensus and it is too fuzzy, static, incomplete and imprecise to be used for decision making. NRDM-2 can be represented on a single page in the form of a "causal diagram" displaying the intervening relationships between goal and policy variables (see Fig. 3.1).

The causal diagram in Fig. 3.1 not only facilitates writing the equations that permit one to perform the arithmetic tasks that will trace Lebanon's development through time (see Appendix A for the model equations and Appendix B for the identification of parameters), but portrays a gestalt-like statement of the Lebanese socio-economic National development system in its own right. The significance of this graphic gestalt in the modeling paradigm is that it takes us out of a communication cul-de-sac providing a common vocabulary and structure of reasoning between individuals, professions, specialists, administrators, and cultures. Because of the sense of fragmentation and isolation conveyed by the Agenda Papers prepared for the CDR, the communicative ability of NRDM-2 is as important as its scientific rigor.



DEVELOPMENT MODEL - 2


FRACT. MANUF. OUTPUT ELECT. EQ. 5
FMOE
MANUF. ELECT. DEM. SUP. MULT. EQ. 6
MEDSM
MANUFACTURING ESTABLISHMENTS EQ. 30
ME
MANUF. LAND FRACT. OCCUP. EQ. 31
MLFO
MANUF. COSTS COST MULT. EQ. 32
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FRACT. MANUF. OUTPUT WATER EQ. 8
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PCMM
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TPMM
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MANUFACTURING OUTPUT EQ. 21
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MP
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MCI
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UIMC
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ICCNO
SURFACE WATER IMPNDMT CONSTR. EQ. 249
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FDSW
MAX. SURF. WATER IMPOUNDMENT CITY EQ. 243.2
MSWICY
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ICC
JOBS PER MANUF. CAPITAL UNIT EQ. 110
JPMCU
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JIM
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GDPPWM
FRACT. MANUF. PROD. INVESTED EQ. 25
FMPI
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CSGDP
CONSTRUCTION PRODUCT EQ. 132
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CONSTRUCTION OUTPUT EQ. 135
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ELECT. UTIL. OUTPUT EQ. 72
EUO
FRACT. E. UTIL. OUTPUT-FUEL EQ. 74
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EUCD
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JOBS IN ELECT. UTIL. EQ. 118
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FRACT. E. UTILITY PROD. INVESTED EQ. 77.1
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WATER UTIL. OUTPUT EQ. 80
WUO
FRACT. W. UTIL. OUTPUT-INPUTS EQ. 81.1
FWUOI
WATER UTIL. PRODUCT EQ. 81
WUP
W.U.C. INVESTMENT EQ. 65
WUCI
W.U.C. DEPRECIATION EQ. 64
WUCD
WATER UTIL. CAPITAL EQ. 78
WUC
JOBS PER W.U. CAPITAL UNIT EQ. 117
JPWUCU
JOBS IN WATER UTIL. EQ. 118
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G.D.P. PER WORKER IN WATER UTIL. EQ. 119
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TELE-COMMUN. PRODUCT EQ. 89
TCP
T.C.C. INVESTMENT EQ. 91
TCCI
T.C.C. DEPRECIATION EQ. 90
TCCD
TELE-COMMUNICATN CAPITAL EQ. 86
TCC
JOBS PER T.C. CAPITAL UNIT EQ. 120
JPTCCU
JOBS IN TELE.-COM. EQ. 121
JITC
GDP PER WORKER IN TELE.-COM. EQ. 122
GDPWTC
FRACT. TELE-COM. PROD. INVESTED EQ. 91.1
FTCPI
INT'L. TRANS. OUTPUT EQ. 94
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FRACT. I.T. OUTPUT-INPUTS EQ. 95.1
FITOI
INT'L. TRANS. PRODUCT EQ. 95
ITP
I.T.F. INVESTMENT EQ. 93
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ITF
JOBS PER I.T. CAPITAL UNIT EQ. 123
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JOBS IN INT'L. TRANS. EQ. 124
JIIT
GDP PER WORKER IN INT'L. TRANS. EQ. 125
GDPWIT
FRACT. INT'L. TRANS. PROD. INVESTED EQ. 97.1
FITPI
LAND TRANS. OUTPUT EQ. 100
LTO
FRACT. L.T. OUTPUT-INPUTS EQ. 101.1
FLTOI
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FLTPI
JOBS IN CONSTRUCTION EQ. 135
JIC
NON-AGRICULTURE JOBS EQ. 137
NAJ
FRACT. BUSIN. OUTPUT INPUTS EQ. 52
FBOI
BUSINESS OUTPUT EQ. 54
BO
BUSINESS PRODUCT EQ. 55
BP
BUSIN. CAP'L. INVESTMENT EQ. 53
BCI
BUSIN. CAP'L. DEPRECIATION EQ. 56
BCD
BUSINESS CAPITAL EQ. 37
BC
JOBS PER BUSIN. CAPITAL UNIT EQ. 110
JPBCU
JOBS IN BUSINESS EQ. 111
JID
GDP PER WORKER IN BUSINESS EQ. 113
GDPPWD
FRACT. BUSINESS PROD. INVESTED EQ. 50
FBPI
FRACT. BUSIN. OUTPUT TRANS. EQ. 50
FBOT
BUSIN.-TRANS. DEM.-SUP. MULT. EQ. 49
BTDSM
RECONSTRUCTN INVEST. BUSIN. EQ. 59
RIB
BUSIN. CAP'L. OUTPUT RATIO EQ. 55
BCOR
FRACT. BUSIN. OUTPUT COMM. EQ. 43
FBOC
BUSIN.-COMMUN. DEM.-SUP. MULT. EQ. 46
BCDSM
NORMAL BUSINESSES EQ. 60
NB
BUSINESS ADDITIONS EQ. 67
BA
COST PER BUS. RESTORATN EQ. 67.1
CPBR
FRACT. BUSIN. OUTPUT WATER EQ. 44
FBOW
BUSIN.-WATER DEM.-SUP. MULT. EQ. 45
BWDSM
DAMAGED BUSINESSES EQ. 61
DB
BUSINESS RESTORATIONS EQ. 68
BR
RESTORED BUSINESSES EQ. 62
RB
COST PER BUSIN. ESTAB. EQ. 66
CPBE
FRACT. BUSIN. OUTPUT ELECT. EQ. 41
FBOE
BUSIN.-ELECT. DEM. SUP. MULT. EQ. 40
BEDSM
BUSINESS ESTABLISHMS EQ. 63
BE
BUSIN. LAND FRACT. OCCUP. EQ. 64
BLFO
BUSIN. ESTAB. COST MULT. EQ. 65
BECM
HIGHWAY CONSTRUCTION EQ. 261
HWYC
HIGHWAY CONSTR. COST EQ. 257
HCC
HWY. CONSTR. COST MULT. EQ. 258
HCCM
HWY. CONSTR. COST NORMAL EQ. 257.1
HCCN
HWY.-LANE KILOMETERS EQ. 255
HLK
LAND PER KILOMETER EQ. 256.1
LPK
HWY. LAND FRACT. OCCUPIED EQ. 256.2
HLFO
LAND ZONED HIGHWAYS EQ. 256.2
LZH
HIGHWAY MAINT. COST EQ. 260
HMC
UNIT MAINT. COST EQ. 259
UMC
VEHICLE-HWY. CONGEST. MULT EQ. 506
VHCM
HWY. USER REVENUES EQ. 261.1
HUR
FRACT. LAND TRANS. HWYS. EQ. 261.1
FLTH
MOTOR VEH. GROWTH NORMAL EQ. 286.1
MVGN
MOTOR VEH. GROWTH RATE EQ. 286
MVGR
MOTOR VEHICLES EQ. 284
MV

3.3. Overview of the Model

NRDM-2 is structured to accommodate three development orientations: (1) resource development, (2) regional development, and (3) sectoral development. Resource components include natural resources, land resources, water resources, and human resources (manpower). Regional development is organized on the basis of rural and urban in NRDM-2. Sectors represented in the model are agriculture, manufacturing, business, infrastructure and government. Obviously, the three orientations overlap. They are also tied together by two quantities most responsible for material growth: (1) population-including the effects of all economic and environmental factors that influence human birth, death, and migration rates, and (2) capital--including the means of producing industrial, service, and agricultural outputs. For the purpose of this report, NRDM-2 is organized as follows:

- Manufacturing (Eqs. 1-36)
- Business (Eqs. 37-69)
- Infrastructure (Eqs. 70-105)
- Manpower (Eqs. 106-137)
- Government Services (Eqs. 138-171)
- Agriculture (Eqs. 172-217)
- Population (Eqs. 218-244)
- Utilities (Eqs. 245-254)
- Highways (Eqs. 255-261)
- Housing (Eqs. 262-277)
- Trade-Energy (Eqs. 278-292)
- Socio-Economic Indicators (Eqs. 293-306)

Many of the sectors in NRDM-2 can be thought of as elements in a national account. The national account is concerned with the measure of aggregate product originating within some geographical area, in this case Lebanon, so that a picture of economic performance can be gained.

The end result of economic activity is the production of goods and services and the distribution of those goods and services to the members of society. The most comprehensive measure of national output is the gross

national product, usually abbreviated GNP. It is the value of all goods and services produced annually in the nation. The task of estimating the GNP, however, is not merely adding up the value of all output because that would be double-counting. In NRDM-2 the "value-added" method is used because in a complex society like Lebanon, there are very few final outputs produced solely by one industry. The final value of any product is created by a large number of different industries; each firm buys materials or supplies from other firms, processes or transports them, and thus adds to their value.

There are four major components of GNP, each representing a final use of GNP: consumption, investment, government purchases, and net exports. Investment refers to that portion of the final output which takes the form of additions to or replacements of capital. Government purchases of goods and services are a second component of GNP. In addition, government makes other expenditures, "transfer payments", which do not represent the purchase of output and are consequently excluded from GNP. Consumption refers to the portion of nation's output devoted to meeting consumer wants. Net exports, exports minus imports of goods and services, are a final use of GNP and must be included in our total. In NRDM-2, three of the four major components are grouped under the heading of GDP for gross domestic product: consumption, investment, and government purchases. It is evident, then, that the GNP is the sum of the GDP plus net exports in the model.

For purposes of national income analysis, GNP statistics are subdivided into mutually exclusive, collectively exhaustive categories. The most commonly used scheme for subdivision is that based on the International Standard Industrial Classification (ISIC). The nine major ISIC categories are listed in Table 3.1.

Table 3.1 International Standard Industrial Classification

Code	Classification and Description
1	Agriculture, hunting, forestry, and fishing
2	Mining and Quarrying
3	Manufacturing
4	Electricity, gas, and water
5	Construction
6	Wholesale and retail trade, restaurants, and hotels
7	Transport, storage, and communication
8	Financing, insurance, real estate, and business services
9	Community, social, and personal services

Each of the nine ISIC economic output divisions in Table 3.1 is associated with a particular capital stock in NRDM-2. In our model the agriculture sector provides most of the output in the first ISIC division. The NRDM-2 manufacturing capital stock provides the output in ISIC divisions 2 and 3. Business capital in the model is associated with the activities listed under ISIC divisions 6 and 8. The infrastructure sector in the model corresponds to ISIC divisions 4 and 7, and the government services sector to ISIC division 9.

THE SCENARIOS

> "I don't understand you", said Alice. "it's dreadfully confusing½" "That's the effect of living backward, "the Queen said kindly; "it always makes one a little giddy at first..."
>
> "Living Backward½" Alice repeated in great astonishment. "I never heard of such a thing".
>
> "...but there's one great advantage in it, that one's memory works both ways, "the Queen continued, ignoring Alice's interruption.
>
> "I'm sure mine only works one way," Alice remarked. "I can't remember things before they happen".
>
> "It's a poor sort of memory that only works backward". the Queen concluded.
>
> Through the Looking Glass

4.1. Introduction

Most development planners approach the task of designing the future with the naivete of Alice in Wonderland. As we study the dialogue between Alice and the White Queen, we begin to understand the Queen's lack of enthusiasm for a memory "that only works backward". No less an authority than Webster vindicates her in his definition of memory as "the power or process of reproducing what has been learned; the persistent modification of structure or behavior resulting from activity or experience". In this section we shall discuss the utilization of a technique called "scenario analysis" which permits one to "learn" and to gain "experience" from the future in much the same manner as one does from the past.

4.2. Generation of Scenarios

In the research we generate three variants of possible future configurations of Lebanese development activity, or three "scenarios". Scenarios are attempts to describe future changes in the state or condition

of a social system--in this case, Lebanon. One of the scenarios has been dubbed the "No-War" Scenario. In this scenario the Lebanese economy is assumed to preserve in the future the pattern that existed in 1975 before the Civil War. The other two scenarios take conditions as they existed in 1980 as the initial state of the system with the difference between the two being whether or not there is a formal reconstruction effort. These are referred to as the "Reconstruction Plan" Scenario and the "No Reconstruction Plan" Scenario.

The three scenarios which cover a fifty year period starting from the present are expressed graphically to facilitate comparison. Specifically, the more than 300 variables of NRDM-2 have been weighted and condensed into 31 indicators representing fourteen socio-economic domains: human resources, wealth, distribution of wealth, government and politics, health, education, housing, land resources, agriculture and food, communications, transportation water resources, energy resources, and pollution. The 31 indicators, in turn, are weighted and combined linearly to produce an overall measure of the quality of life.

The development indicators selected for aiding in scenario analysis are summarized in Table 4.1. In Table 4.2 the values assigned to parameters in NRDM-2's equations in order to generate the three scenarios are given. For example, the values in the first column are based on the CDR five-year plan that was unveiled in 1979. This plan has been interpreted as follows. Private sector needs are reckoned at 9 billion Lebanese pounds, 0.8 billion per year for five years to manufacturing (Equation 26) and 1.0 billion per year for five years to business (Equation 59). It includes 10 billion Lebanese pounds over five years in the public sector spread among telecommunications (Equation 92), ports and airports (Equation 98), highways

TABLE 4.1 DEVELOPMENT INDICATORS FOR COMPARISON OF PRINCIPAL SCENARIOS

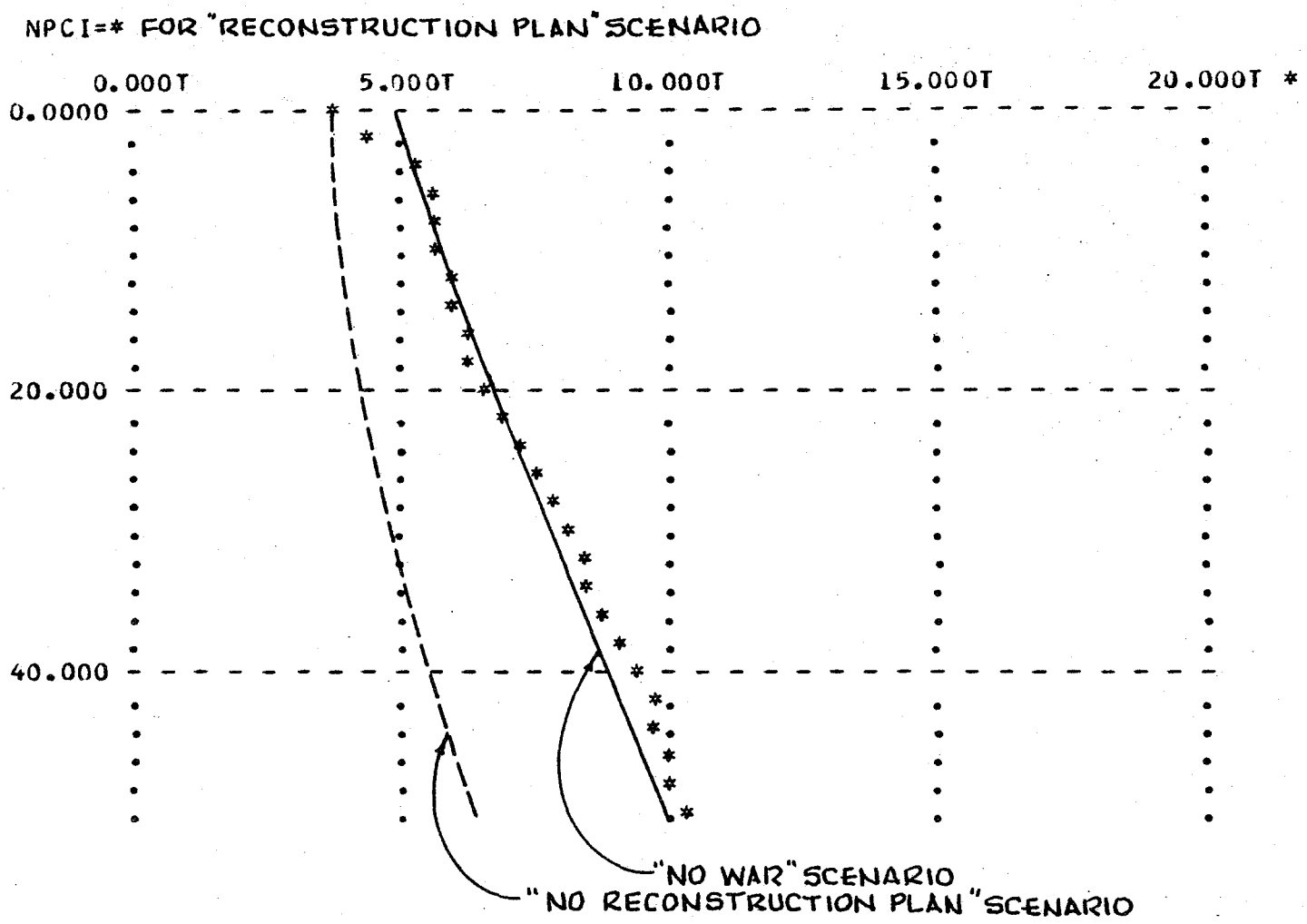
INDICATOR AND CATEGORY	VARIABLE	EQ. NO.	FIG. NO.
HUMAN RESOURCES			
1. National Population	NP	220	4.2
2. Percentage of Population Urban	POPU	370	4.3
3. Annual Natural Population Increase	ANPI	308	4.4
4. Percentage of Population of Working Age	PPWA	309	4.5
WEALTH			
5. Gross National Product	GNP	291	4.6
6. National Per Capita Income	NPCI	222	4.7
7. Population Density	POPDEN	310	4.8
8. Trade Balance Percentage of GNP	TBPGNP	311	4.9
DISTRIBUTION OF WEALTH			
9. Percentage Unemployment	PUNEM	312	4.10
10. Relative Rural Income	RRI	225	4.11
GOVERNMENT AND POLITICS			
11. Budget as Percentage of GNP	BPGNP	315	4.12
12. Govt. Transfer Payments as % of GNP	TPPGNP	316	4.13
HEALTH			
13. Population Per Physician	PPP	295	4.14
14. Percentage Health Subsidized	PHSUB	317	4.15
EDUCATION			
15. Adult Literacy	ALT	302	4.16
16. Percentage Education Subsidized	PESUB	319	4.17
HOUSING			
17. Average No. Rooms Per Person	ANRPP	300	4.18
18. Dwelling Unit Difficiency	DUD	268	4.19
LAND RESOURCES			
19. Urban Population Density	UPOPD	321	4.20
20. Average Farm Size	AFSIZ	322	4.21
AGRICULTURE AND FOOD			
21. Food Per Capita	FPCC	323	4.22
22. Percentage Ag. Land Irrigated	PALI	324	4.23
COMMUNICATIONS			
23. Television Sets Per Capita	TSPC	325	4.24
24. Cinema Attendance Per Capita	CAPC	326	4.25
TRANSPORTATION			
25. Motor Vehicles Per Capita	MVPC	297	4.26
26. Highway Density	HWYDEN	328	4.27
WATER RESOURCES			
27. Surface Water Impoundment Capacity Per	SWICPC	329	4.28
28. Water Demand Supply Ratio	WDSR	82	4.29
ENERGY RESOURCES			
29. Per Capita Energy Consumption	PCEC	296	4.30
30. Fuel Imports as Percentage of GNP	FIPGNP	330	4.31
ENVIRONMENT			
31. Pollution Ratio	POLR	17	4.32
32. Quality of Life	QOL	331	4.33

TABLE 4.2 PARAMETER SUMMARY FOR SCENARIO ANALYSIS

Eq.No.	Parameter	Parameter Values for Three Scenarios: Reconstruction Plan	No. Reconstruction Plan	No 1975-76 Civil War
1.2	MCN	4.8E9	4.8E9	8.0E9
25.1	FMPIX	.40	.20	.40
25.2	FMPIY	.45	.20	.40
25.3	RECPEF	5.	50.	0
26.1	RIMC	.8E9	0	0
27.2	NMN	3000	3000	6000
28.2	DMN	3000	3000	0
35.1	MRP	600	60	0
37.2	BCN	18.0E9	18.0E9	24.0E9
58.1	FBPIX	.35	.25	.35
58.2	FBPIY	.40	.25	.35
59.1	RIBC	1.0E9	0	0
60.2	NBN	20000	20000	30000
61.2	DBN	10000	10000	0
68.1	BRP	2000	200	0
70.2	EUCN	1.0E9	1.0E9	1.2E9
78.2	WJCN	1.0E9	1.0E9	1.2E9
86.2	TCCN	.5E9	.5E9	1.5E9
92.1	RITCC	.44E9	0	0
93.2	ITFN	1.0E9	1.0E9	1.5E9
98.1	RIITC	.1826E9	0	0
99.2	LTFN	3.0E9	3.0E9	4.5E9
104.1	RILTC	.485E9	0	0
108.1	FMPGX	.05	.03	.05
108.2	FMPGY	.05	.03	.05
112.1	FBPGX	.10	.05	.10
169.1	RILIHC	.10	.05	.10
224.1	RNPCIN	.894E9	0	0
255.2	HLKN	3.6	3.6	4.8
258.1	HCCMT	1.2E4	1.2E4	1.8E4
262.2	UIDN	.9/.9/1/2/10/40	.9/.9/1/2/10/40	.9/.9/.9/1/8/25
263.2	LIDN	.75E6	.75E6	1.0E6
270.1	DCCMT	.7/.8/1.2/2.5/5/10	.7/.8/1.2/2.5/5/10	.7/.8/1/2/4/7
287.2	MYN	250000	250000	300000
36.1	FMOGC	.055	.05	.05
69.1	FBOGC	.105	.10	.10

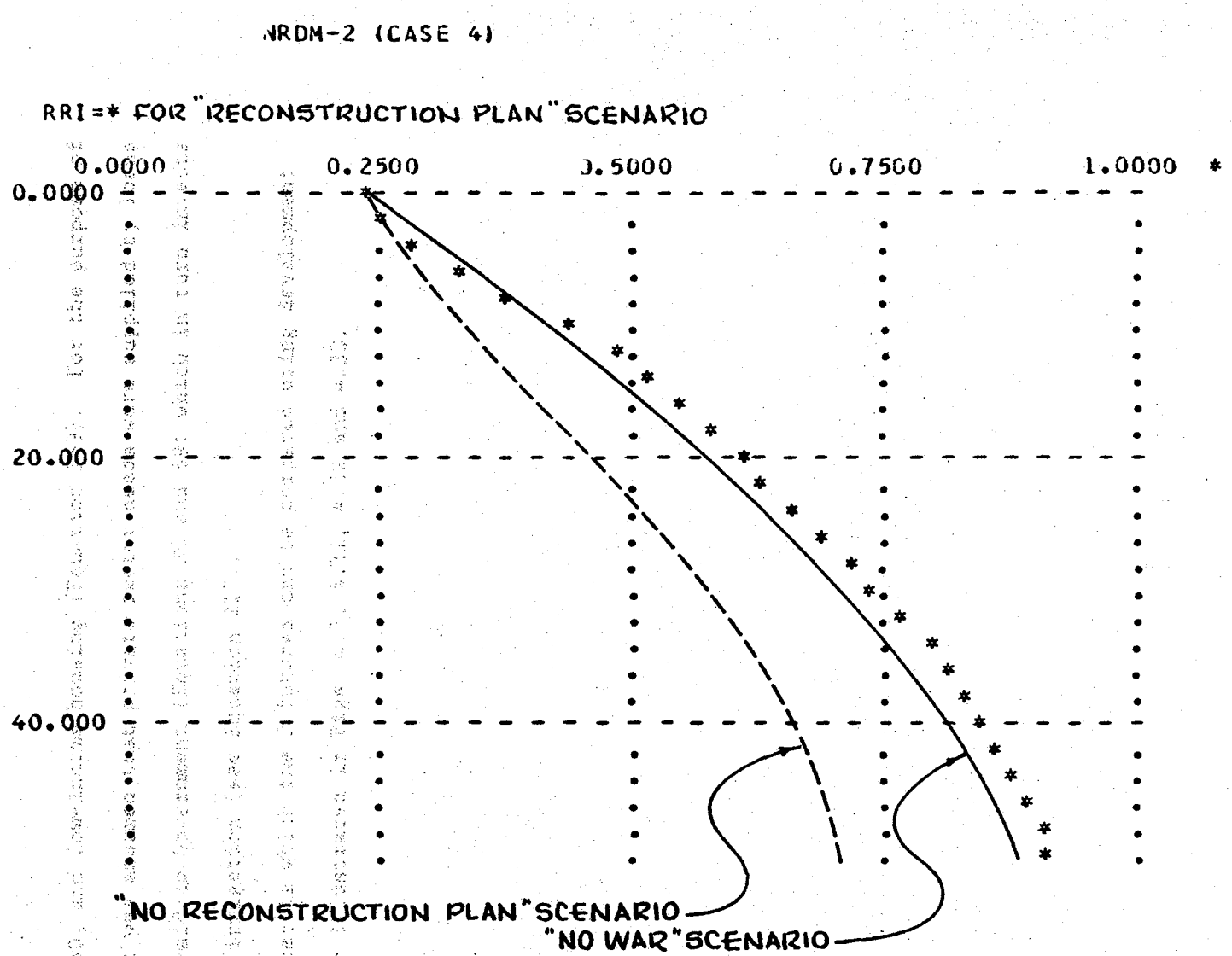
(Equation 1040, and low-income housing (Equation 169). For the purpose of this study it was assumed that private sector needs were supplied by loans which are repaid to Government (Equations 36 and 69) which in turn invests the money in irrigation (see Equation 217).

The manner is which the 3 futures can be compared using development indicators is illustrated in Figs. 4.7, 4.11, 4.32 and 4.33.



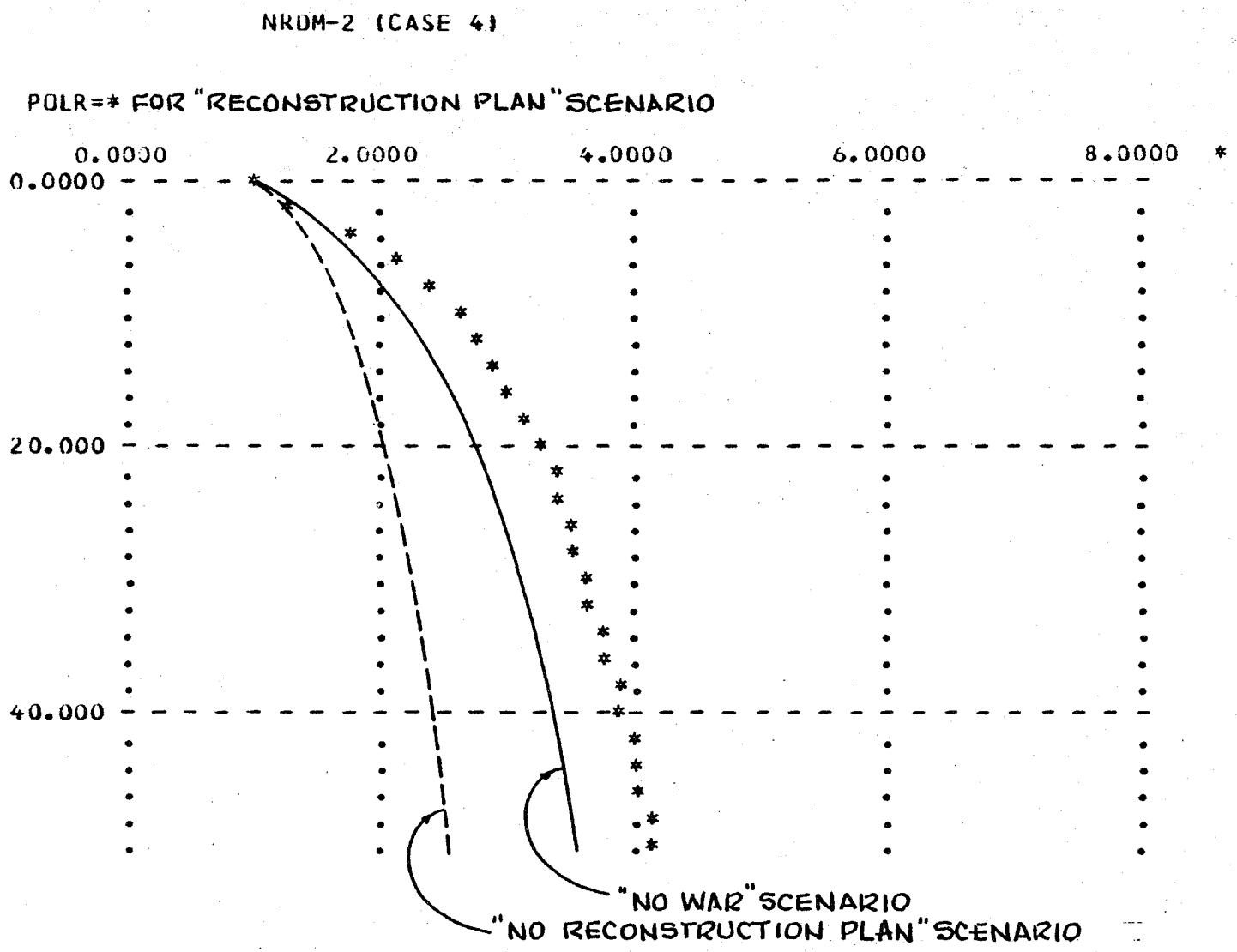
3 SCENARIOS IN TERMS OF NPCI-NATIONAL PER CAPITA INCOME

FIG. 4.7



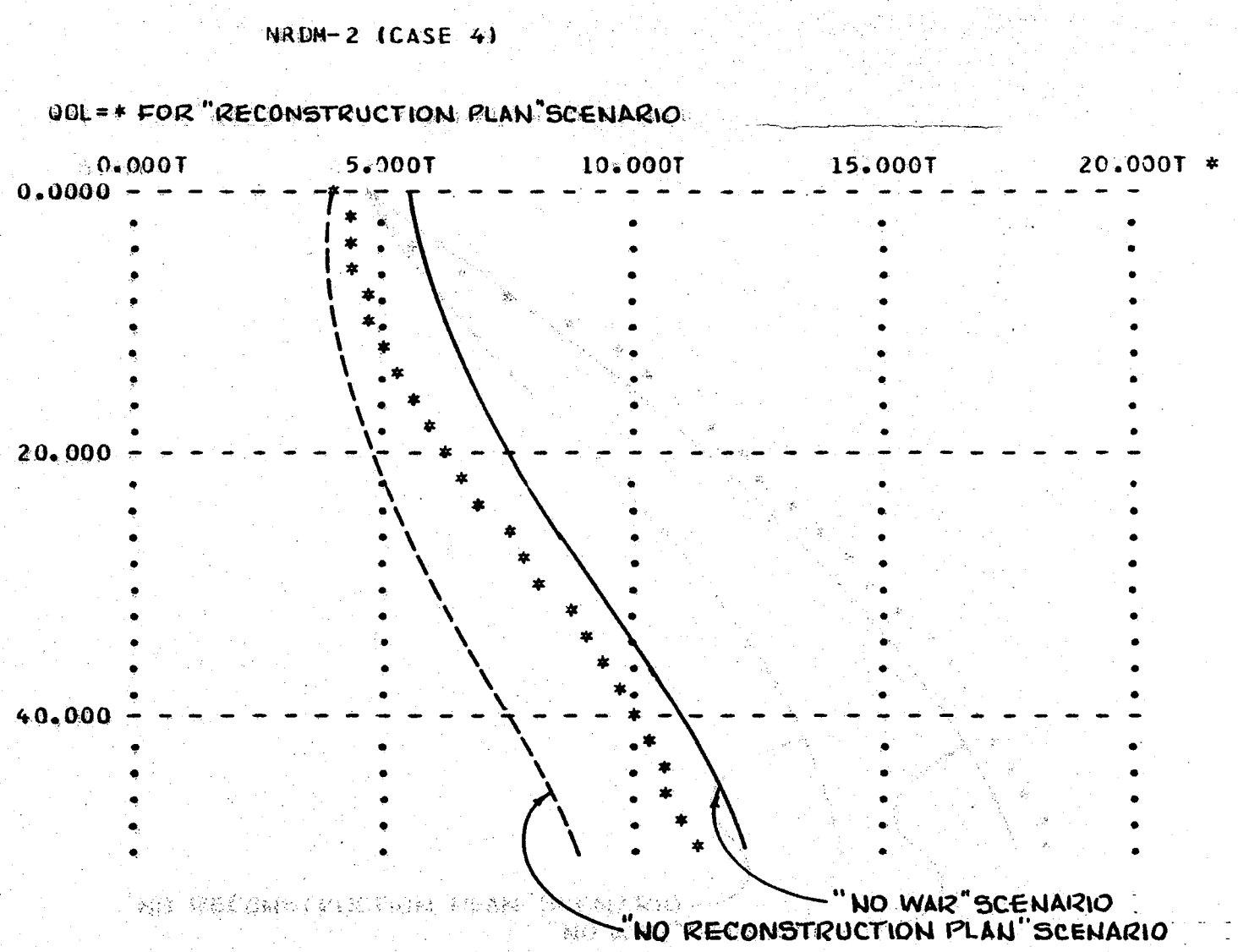
3 SCENARIOS IN TERMS OF RRI - RELATIVE RURAL INCOME

FIG. 4.11



3 SCENARIOS IN TERMS OF POLR-POLLUTION RATIO

FIG. 4.32



3 SCENARIOS IN TERMS OF QOL-QUALITY OF LIFE

FIG. 4.33

THE POLICIES

> I am not ignorant that many have been and are of the opinion that human affairs are so governed by fortune and God, that men cannot alter them by any prudence of theirs, and indeed have no remedy against them; and for their reason have come to think that it is worth while to labor much about anything, but that they must leave everything to be determined by chance.
>
> I think it may be the case that Fortune is the mistress of one half our actions and yet leaves the control of the other half, or a little less, to ourselves. And I would liken her to one of those wild torrents which, when angry, overflow the plains, sweep away trees and houses, and carry off soil from one bank to throw it down upon the other. Every one flees before them, and yields to their fury without the least power to resist. And yet, though this be their nature, it does not follow that in seasons of fair weather, men cannot, by constructing weirs and moles, take such precautions as will cause them when again in flood to pass off by some artificial channel, or at least prevent their course from being so uncontrolled and destructive.
>
> The Prince

5.1. Introduction

On April 28, 1981 Isreali jet fighters shot down two Syrain helicopters over Lebanon. In response Syria brought up lethal Soviet-made SA-6 surface-to-air missiles to counter the threat. As Syria and Isreal braced for a violent showdown that could bring war to the region once again--and one, moreover, that conceivably could drag in the superpowers--the U.S. and the Soviet Union moved swiftly to restrain their respective allies. Caught in the middle, as always, battered Lebanon anxiously waited for others to settle its fate. Nothing could underscore more dramatically the flimsiness of Lebanon's grip on its own destiny.

We have introduced this section with one of Niccolo Machiavelli's admonitions to his Prince. The message is clear: Fortune helps those who help themselves. Dr. Salim El-Hoss as Prince Minister of Lebanon echoed this

sentiment in an eloquent, inspiring address at the 110th Commencement of the American University of Beirut:

> "...we should not cajole ourselves into believing that a conspiracy was the sole cause of our crisis, and be blinded by it to the existence of other factors. If we were to do this, we would deserve the accusation of those who say that the Lebanese crisis has produced many lessons, but it has failed to produce those who can heed them. Let us then pause a while and give a little thought to our affairs. In the days when we were at the apogee of our fortune we were not superior to other, any more than today, in our decline, we are more abject than others. Yesterday, the intoxication of success prevented us from perceiving our shortcomings and from foreseeing the pitfalls that were lying in wait for us; today, the humiliation of our decline should not similarly prevent us from seeing those virtues that are ours and from striving to regain our health and well-being."

5.2. Knowledge and Development

Of all the problems of human affairs, those associated with national development are the most perplexing. The evolution of theories of socio-economic development is a fascinating story of intellectual inventiveness and ideological self-delusion. Why is it that there aren't significant correlations between development and mild climatic environments or between development and a abundance of natural resources? It is evident that some countries have "played their cards" better than others.

Development is a metaproblem--one that crosses disciplines, is value-ridden, and requires trade-offs between competitive ends. In combating the development metproblem, there is no weapon more potent than knowledge, no

panacea more effective than the understanding that knowledge can bring. But what kind of knowledge?

Consider the evolution of civilization: In primitive societies, the existing systems were these arising in nature and their characteristics were accepted as devine and as beyond man's comprehensive and control. As industrial societies emerged, socio-economic systems became so complex and their behavior so confusing that they were attributed to random, irrational causes. Development was a matter of luck, and luck was looked on as a loving mother with too many children to attend. Gradually over the past century it has become clear that a barrier to achieving development is the fragmentation of knowledge and our inability to structure it.

Whereas there has been exponential growth in fundamental knowledge of the environment and society, there is a scarcity of knowledge concerning the design and operation of the systems using this knowledge. While human capacities to shape the environment and society are rapidly increasing, policymaking capabilities to use these capacities are not. For example, we can create a gene in a test tube reflecting our understanding of the basic secrets of the life process, while at the same time we cannot handle the population explosion, a manifestation of the most primitive biological urge. It is the growing gulf between the capacity to control the environment and society, on one hand, and the knowledge of how to design and operate our societal meta-control systems so they can use these capacities, on the other hand, which constitutes the major obstacle to development.

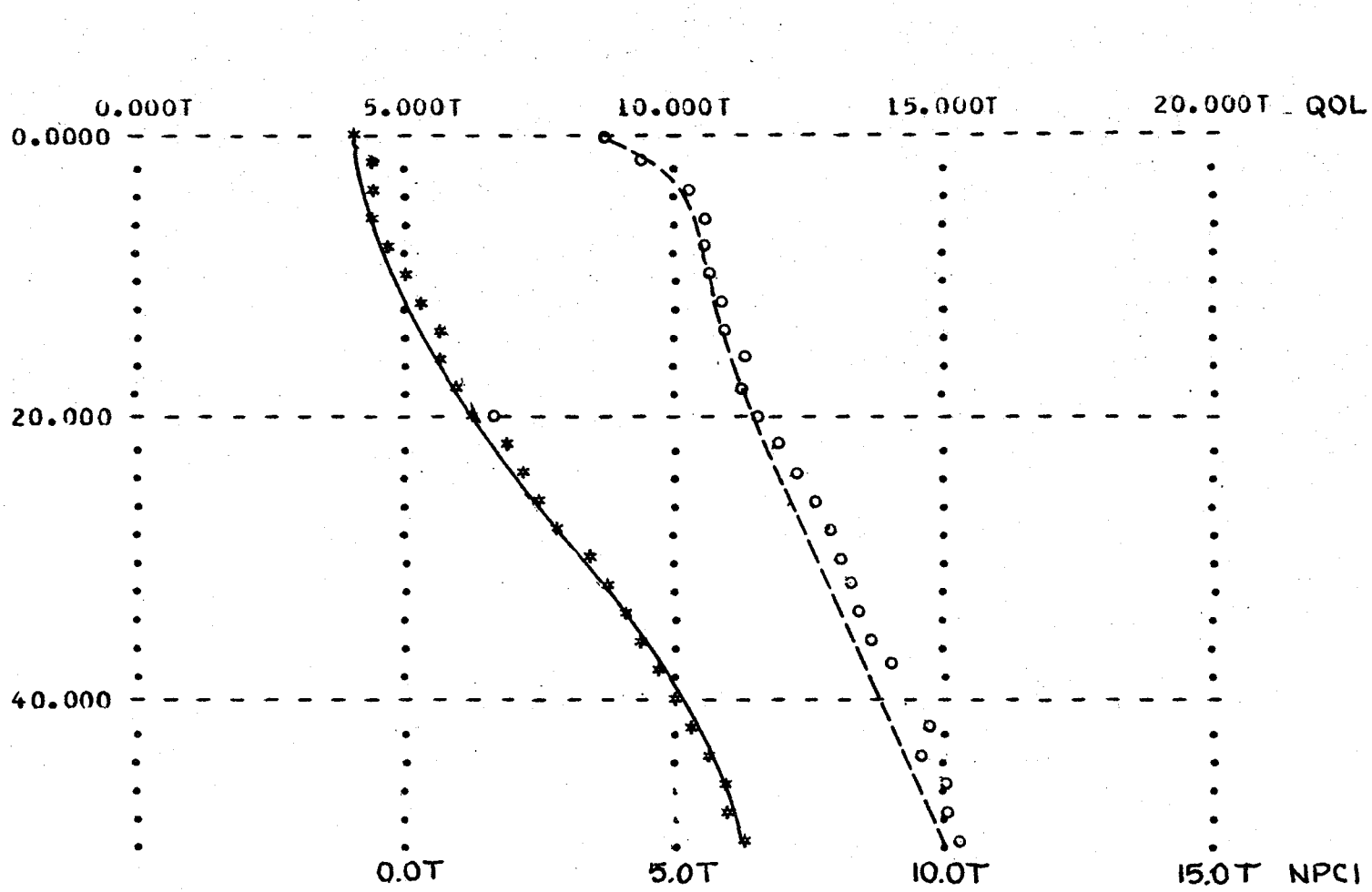
5.3. Policy Experiments

Armed with the knowledge that we have in NRDM-2 the capability to observe the time paths of hundreds of socio-economic variables over the next 50 years of Lebanon's future, we are about to do what all development

planners would like to be able to do: to see what the next 50 years would look like if any of several variations in the Reconstruction Plan Scenario are substituted. This will be illustrated by testing two hypothetical policies identified as a Taxation Policy and a Zoning Policy.

Taxation Policy. Traditionally Lebanon has tended to pursue a policy favorable to private interests--laissez faire. But if social justice is to accompany physical and economic reconstruction, it is doubtful that needed social programs in the future can be undertaken without a budget fueled by taxes. To show how we use NRDM-2 to experiment with various tax policies, two computer cards were changed and a simulation run was made. Specifically, the parameter FMPGX, the Fraction of Manufacturing Product to Government after Reconstruction which is Equation 108.1, was made equal to .10, and the parameter FBPGX, the Fraction of Business Product to Government after Reconstruction which is Equation 112.1, was made equal to .15. Recall from Table 4.2 that under the basic Reconstruction Plan Scenario the values used for these two parameters were FMPGX = .05 and FBPGX = .10. Referring to Table 4.2, note that the two fractions during the period of reconstruction would remain .05 and .10 respectively. Thus, the tax increase would take effect after the formal reconstruction period. One result of this computer run is presented in Figure 5.1. To facilitate evaluation and comparison to the basic Reconstruction Plan Scenario of this modified plan, some of the same development indicators employed for comparison of the three principal scenarios in Table 4.1 are used.

Zoning Policy. Zoning decisions determine the supply of land available for various socio-economic activities. In Lebanon zoning is an unexploited policy instrument. The amount of land and its use influence such



MODIFIED RECONSTRUCTION PLAN SCENARIO BASED ON TAXATION POLICY

FIG. 5.1

things as the present and future housing market, population mix, economic growth, employment conditions, and environmental quality. Since a country must live with its zoning decisions for decades, local decisions affecting land use should be made in the context of the total national system. Land zoning policy tests afford a basis for accomplishing this. To illustrate this capability, four parameters in the model were changed as indicated below:

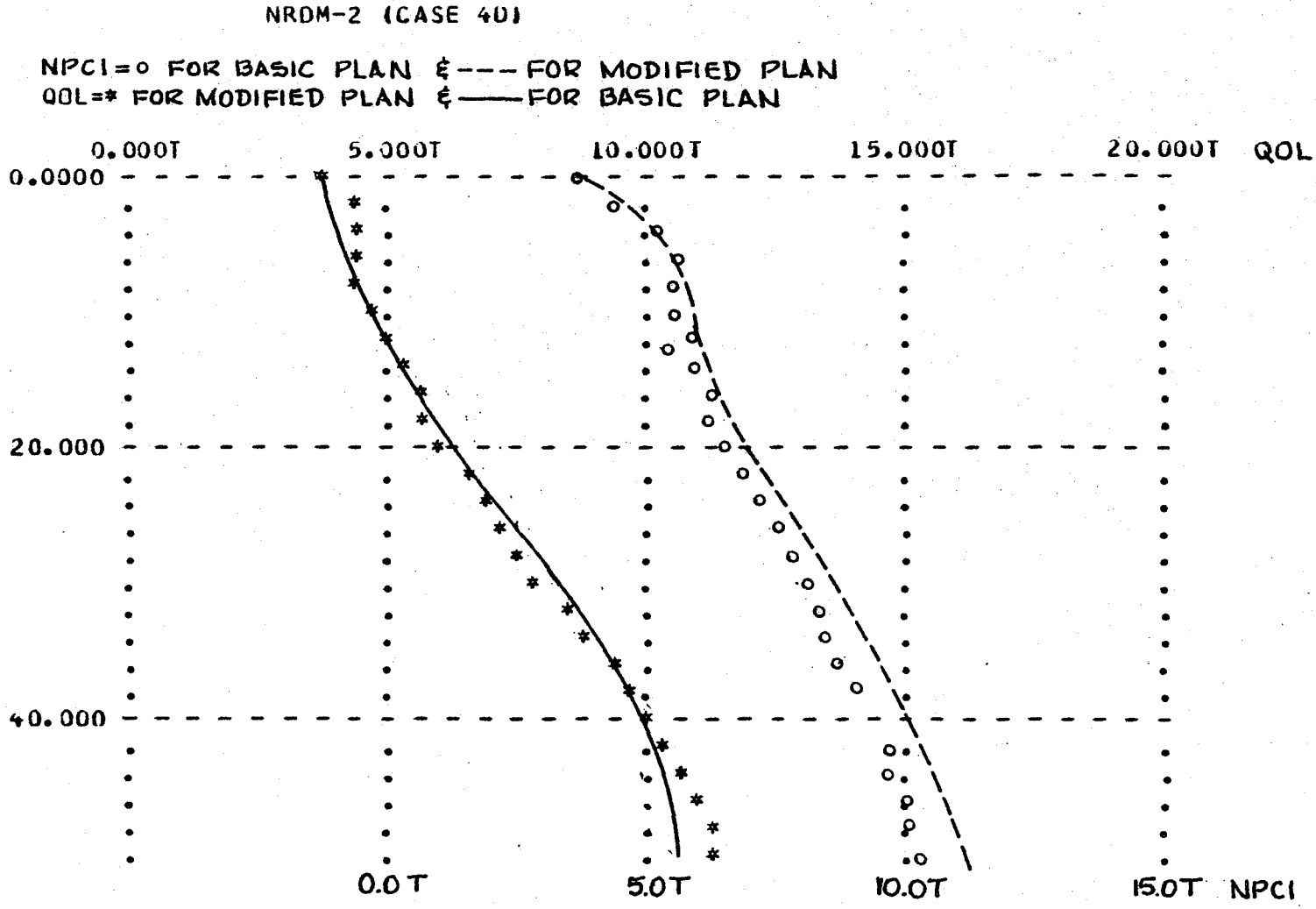
Parameter Name	Description	Equation	Normal Value (ha)	Present Value (ha)
LZM	Land Zoned for Manufacturing	31.2	4500	6000
LZB	Land Zoned for Business	64.2	8000	10000
LZH	Land Zoned for Highways	256.2	1500	2000
LZD	Land Zoned for Dwellings	269.2	10000	12000

The impacts of the present policy values on selected development indicators are shown in Figure 5.2.

5.4 Sensitivity to Exogenous Factors

In addition to policy experiments, additional experiments can be performed with NRDM-2 to try to ascertain the potential effects of factors such as fuel costs and world economic development that are beyond Lebanon's control.

National Cost of Fuel, NCF. This variable in NRDM-2 is defined in Eqs. 285 and 285.1. Translating the equations from mathematics to English: the present cost of fuel in Lebanon is taken as 750 LL per TOE (Ton-Oil--Equivalents) and that it increases steadily to 2500 LL/TOE in the year 2030. How good is this assumption? How critical is it?



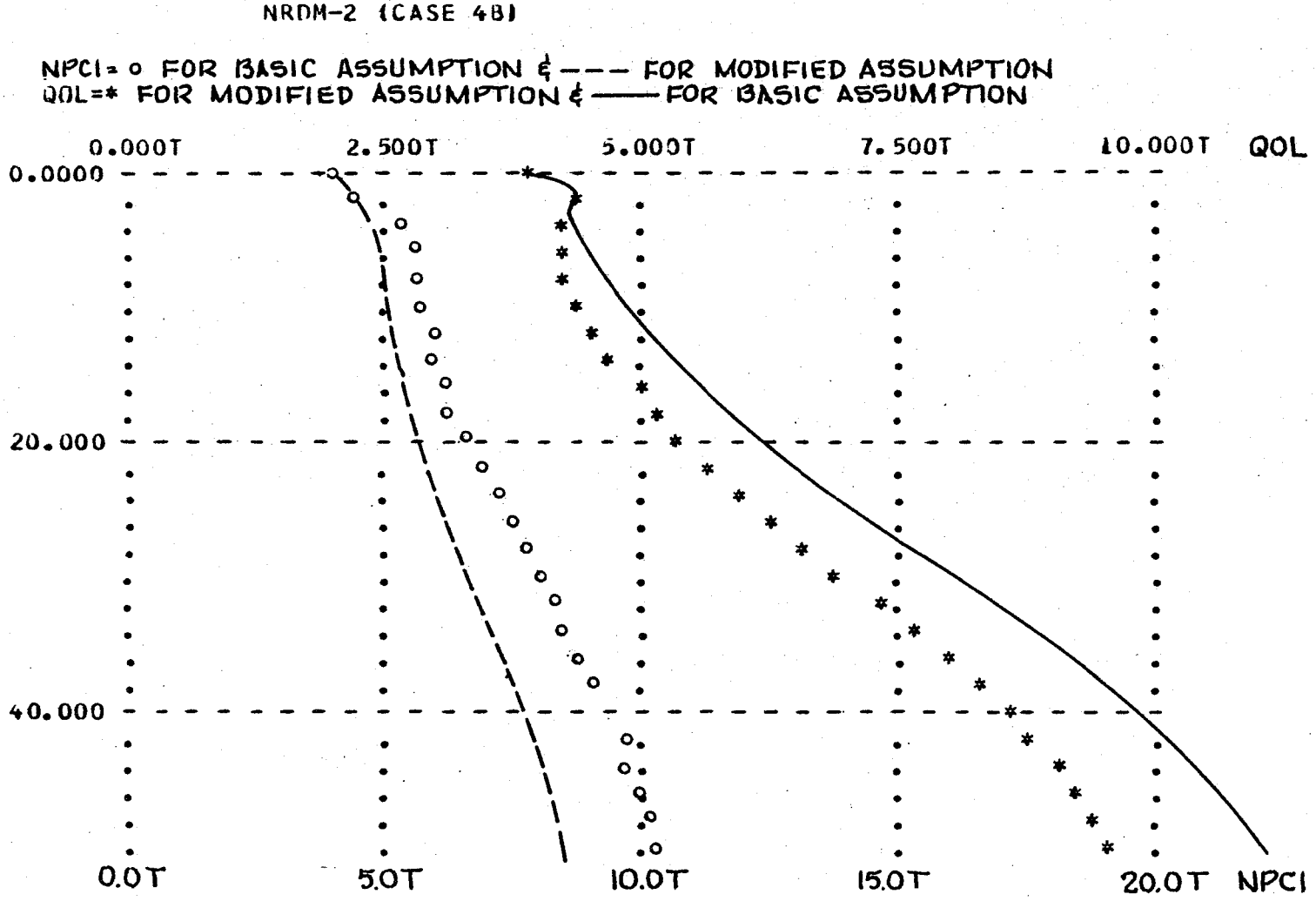
MODIFIED RECONSTRUCTION PLAN SCENARIO BASED ON ZONING POLICY

FIG. 5.2

Fortunately it is not the task of this research or any research to forecast the values of its exogenous variables, but only to understand the effects of varying forecasts on important national development indicators. The effects of a steady state value in 50 years for the exogenous variable NCF that is twice that assumed originally in NRDM-2 is shown in Figure 5.9 for selected development indicators.

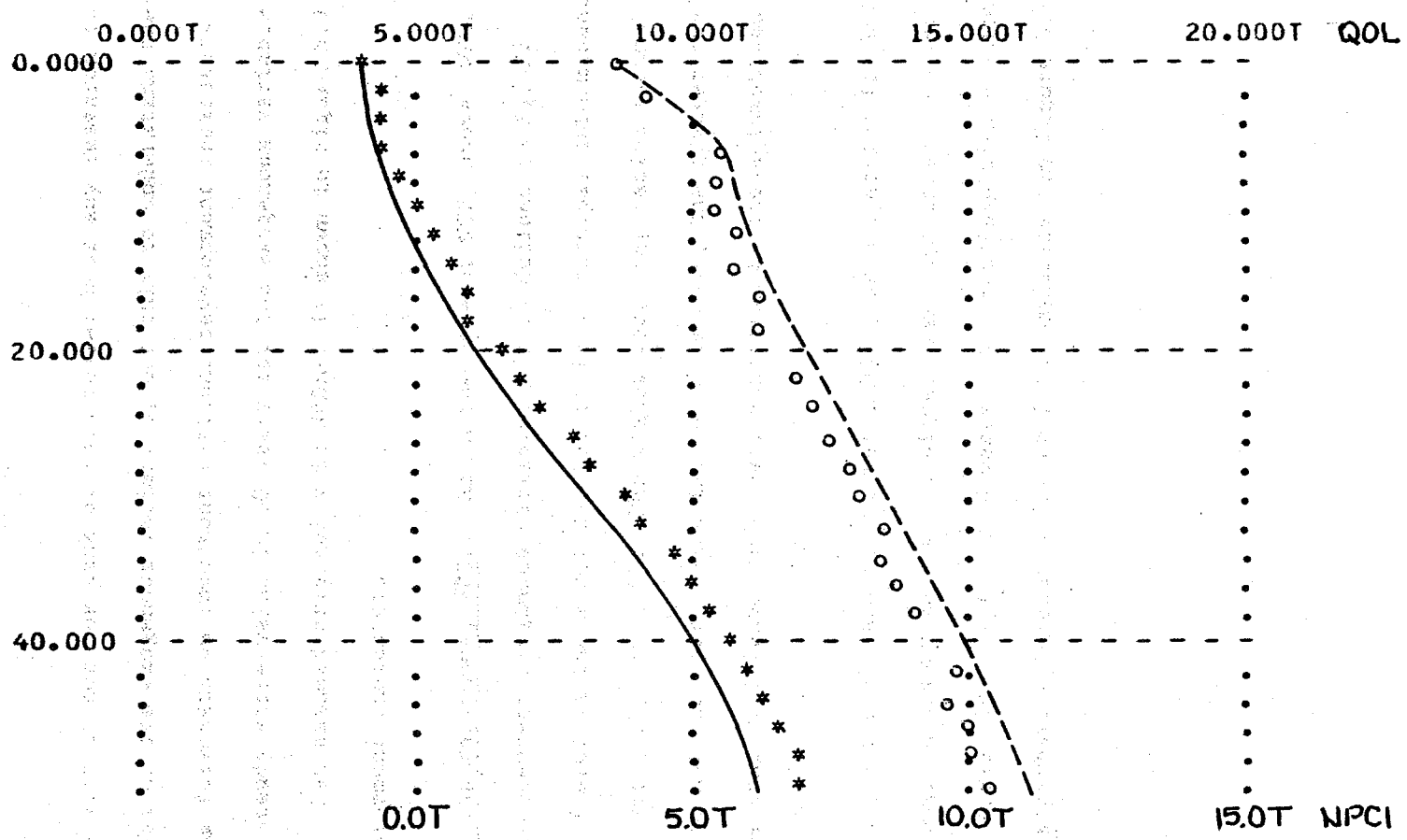
World Per Capita Income, WPCI. As in the case of NCF, above, WPCI is treated as a time-dependent exogenous variable. It is defined in Eq. 221. The significance of WPCI in the model is that it is a principal determinant of the Emigration Rate, ER (Eq. 235). The higher world per capita income with respect to the national per capita income in Lebanon, the greater the number of Lebanese that will leave each year, according to the assumptions in the model.

If we accept a recent report, "Global 2000", our projection for WPCI is NRDM-2 is too low. An experiment was designed based on almost doubling WPCI so that it reached 2300 LL/yr. in 50 years. A comparison of the outputs based on the two alternative forecasts for WPCI is summarized in Figure 5.11.



EFFECT ON LEBANON OF NCF-NATIONAL COST OF FUEL

FIG. 5.9



EFFECT ON LEBANON OF WPCI-WORLD PER CAPITA INCOME

FIG.5.11

THE SKEPTICS

> Things being thus ordered, he would defer the execution of his designs no longer, being spurred on the more vehemently by the want which he esteemed his delays wrought in the world, according to the wrongs that he resolved to right, the harms he meant to redress, the excesses he would amend, the abuses that he would better, and the debts he would satisfy. And therefore, without acquainting any living creature with his intentions, he, unseen of any, upon a certain morning, somewhat before the day, armed himself cap-a-pie, mounted on Rozisante, laced on his ill-contrieved helmet, embraced his target, took his lance, and by a postern door of his base-court issued out to the field, marvellous jocund and content to see with what facility he had commenced his good desires.
>
> DON QUIXOTE

6.1 Introduction

We are at the dawn of a new era--an information systems age that will change forever the way the world works, plays, travels, and even thinks. Just as the industrial revolution dramatically expanded the strength of man's muscles and the reach of his hand, so the computer revolution will magnify the power of his brain. But unlike the industrial revolution, which depends on finite material and energy resources, the new information systems age will be fired by a limitless resource--knowledge.

The driving force behind the revolution lies in fundamental developments in computer technology--ranging from silicon chips eched with powerful circuitry on the hardware side to interactive problem-oriented languages on the software side. The result is a problem-solving aid of enormous potential. Because of these developments, systems analyst have begun to approach the public decision makers with computer models to permit him to understand the future implications of present decisions and policies. It would appear logical that any such tool which could add rigor and scope to analysis and understanding would be wholeheartedly embraced. The question

is: Why is the systems approach in general and computer models in particular not so avidly espoused? The answers range from skepticism that such grand endeavors are quixotic to deeply seated psychological and intellectual prejudices.

6.2 Enemies of the Systems Approach

In order to understand why the world's leaders have not more rapidly responded to computer modeling as tools for development planning, we must first appreciate the fact that they're not "in" the systems approach but rather live and decide "outside" it. Churchman has gone so far as to coin the idea of the "enemies" on the systems approach--approaches to human life that are not comprehensive, holistic, or rational. His sword falls on the humanities as he singles out politics, morality, and aesthetics as entities that have in common a tendency of rejecting the reality of the whole system in lieu of single-minded; short-sighted, piecemeal approaches.

Far more formidable than the humanities as foes of the system approach and their offspring, large-scale interdisciplinary computer models, are the management and academic establishments. While politics, morality and aesthetics are merely implausible enemies, modern management and education are implacable adversaries.

One of the paradoxes of the "traditional approach" to problem solving is that in spite of the rapid pace of technological change and growth in fundamental knowledge, solving contemporary problems using the traditional approach has not become easier. The reason is overspecialization--the tendency for professionals to narrow their focus and for scientists to compartmentalize their knowledge. The results were inevitable: (1) within disciplines, there is needless replication of research and duplication of effort; (2) between disciplines, we find authors tending to differentiate

their findings with contrived superficiality rather than contributing to the unity of science; and (3) throughout the professions and the scientific disciplines, there is a lack of social concern simply because the social need rarely expresses itself in a form to which the specialists' knowledge is simply and directly applicable.

The traditional approach to problem solving is inadequate because it is based on a philosophy that is knowledge-oriented, rather than problem-oriented. Problems are framed intellectually as philosophical questions and pragmatically as merely technological deficiencies. As to the latter, the myth of the technological fix was exposed during and the energy crisis of 1974 when it dawned on humanity that the world and its resources were finite. As to the former, the scientific philosophy underlying the traditional approach aimed only at understanding the world, not improving it. While proclaining itself as the science of the general, its essence as thus conceived was analysis, not synthesis. The approach was the division of traditional problems into a number of separate and less baffling questions. The maxim of success was: "Divide and conquer". The ultimate end was the conceptualization of the world as a whole and the unity of science. But one does not accomplish either through reconstruction of the pieces into which they have been disassembled.

The traditional approach to problem solving is wrong because it assumes that the structure of the environment and of society are isomorphic with the structure of physical science and social science, respectively. Traditionally, in order to understand what appeared to him to be diverse aspects of reality, man has developed different scientific disciplines: engineering, medicine, law, management, physics, chemistry, biology, mathematics, philosophy, sociology, geography, history, economics, etc. And

in solving different problems man has relied on experience and expertise in relevant disciplines. But our academic disciplines have proven to be more convenient ways of organizing our knowledge than applying it because the environment and society and the problems and the phenomena they present are transdisciplinary.

Development is more than a physical or economic concept. It is both a desired state of a system and the process by which that state is achieved. National development is a measure of a country's vulnerability to externalities and of the extent that it is in control of its own destiny. It can be furthered by a set of possible change; technological (projects), socio-economic (policies and programs) and cultural (education). Lastly, development is a complex multigoaled metaproblem--one that entails variables from many academic disciplines, involves the necessity to impose some sort of balance between several apparently competitive ends, and requires ethical interpretation. Metaproblems, in general, and the development metaproblem, in particular, rarely receive rational scientific attention because they remain outside any traditional problem solving discipline and are seldom shared with the new systems scientists, for reasons succinctly articulated by Sutherland. First of all, administrators tend to limit the use of their interpretation of systems analysis to the tactical sub-problems framed to match disciplinary expertise while tackling the critical strategic functions, that should have included the definition and partitioning of the problem as well as the synthesis of solutions, with casual deduction and raw speculation. The partners in crimes of omission and commission are the traditional physical and social scientists who restrict their inputs in the traditional problem solving process to their well-tended little plots of specialized knowledge of the environment and of society, respectively. A

metaproblem, itself, never receives their attention because of the inadequacy of their techniques and the irrelevancy of their philosophy. Neither the traditional approaches in the soft sciences nor the hard sciences suffice for solving metaproblems--the former are verbal, qualitative and do not permit manipulation; the latter are wrapped obscurely in the mathematics of calculus and are only useful for simpler sub-problems. Then there is the disclaimer that value-ridden issues are not the proper province of science anyway--a self-serving excuse for avoiding complicated, intractable problems so as to concentrate on simpler questions that guarantee quick completion experiences.

Finally, society absolves the most critical issue affecting it--the development metaproblem--from true systems analysis because of bureaucratic arrogance and technocratic apprehension. A bureaucracy is a government characterized by specialization of functions with strict adherence to a rigid formal routine. A technocracy is government by technical experts. In the former the development metaproblem and its issues, such as energy and the environment, rural and urban, economic growth and social justice, guns and butter, inflation and unemployment, are framed as examples of irresolvable differences to be accommodated in accordance with the relative weights of the various constituencies; in the latter, as alternatives to be analyzed through the performance of quasi-optimal trade-offs. For the bureaucrat, there are no social problems--only political pressures.

6.3. The Promise of the Systems Approach

We have come to the conclusion that society is a system which is being dragged down by its own inefficiency. The system operates through a set of institutions which worked well enough in a more leisurely age. But now its relaxation times no longer match the rate of perturbations and our

systems at all levels of government are actually designed to have wastable outputs. A systems approach to the future is needed.

When development--the control of our density--is considered in systems terms, some of the bewildering complexity of our world and its cities and its regions disappears. The broad, subjective goals of development seem to find meaning in the concept of entropy. While development in this context is maximization of negentropy, this is not an application of a law of physics, but merely a method of reasoning that helps to show us what must be done. We must redesign our institutions because requisite variety for running the world, a nations, or even a great city does not exist in any man's head, whether he is a premier, president, party secretary, governor, mayor, congressman, economist, engineer, or clergyman.

While it is possible for experts to understand portions of development systems fairly well, but to put together more than a few of these relationships in an internally consistent manner without a formal technique is impossible. Development systems are composed of many feedback loops with delays, nonlinearities, and noise in the information channels and their behavior cannot be anticipated by studying isolated portions sequentially. The difficulty multiplies when considerations of policy formation and their impacts are needed. It is well within the state-of-the-art for us to improve our mental models for policy analysis and planning through the development and use of computer simulation models such as NRDM-2.

Simulation of a socio-economic system like a region involves building and operating a model designed to represent those features of the system which are deemed to be significant in view of the objectives behind the simulation. Some of the more obvious benefits of simulation include: (1) forecasting of macro behavior; (2) predicting consequences of government

actions and refusal to act; (3) conducting sensitivity analysis to establish research and data gathering priorities; and (4) providing aids to communication among specialists and in the achievement of understanding.

It is known that the construction of computer simulation models help free development planners from a mechanistic, deterministic view of a region, and provide them with a more dynamic and comprehensive tool for influencing change. Specific potential uses of URDM-2 include: (1) providing a means for implementing a systems capability, (2) monitoring progress during policy implementation, (3) comparing strategic alternatives, and (4) as a pedagogical tool aiding in the training of a cadre of development planners.

6.4. Summary and Conclusions

During the last two decades, Lebanon has witnessed rather sudden prosperity which not even the Civil War could suppress. It has also engaged in a rat-race for procuring the largest share of the bonanza with the least expenditure of effort in the shortest time possible--illegitimately if necessary. The intensity for the need for success has resulted in the bending of the interpretation of such words as professionalism, scholarship, honor, and equity. Illegitimate means, before the war, gradually became justifiable, and justifiable means, during the worst period of the war in 1975-76, have become laudable by many--described as "guile" and even "genius" as long as it succeeds.

Post-war Lebanon is like post-war U.S.A. in many respects, where ills are attributed to changes beyond control and variously to lack of will, moral decay, selfishness, and the scattering of community responsibility. While these are factors, the key is that these nations want everything without considering--what in systems terms is called--the trade-offs. You can't stress freedom as well as order, individual liberty as well as equality,

security as well as profits from risks taken, and material wealth along with spiritual worth. These are conflicting values. Lastly, you can't have anything without taxation and conscription.

Most people do not worry about the Lebanese people because of their resourcefulness and propensity to move to countries where there are opportunities when the times are right: they worry about Lebanon. The experiment with alternate forecasts of world per capita income in Section 5 as an exogenous input to NRDM-2 dramatizes the necessity of taking a world view in approaching the problems of Lebanon's reconstruction and development.

Therefore, the purpose of this section is twofold: (1) to incorporate a world view into this research and (2) to try to diffuse anxieties regarding the study's approach ("systems") and its instrument ("NRDM-2"). In responding to this purpose we have ranged far and wide because we believe that the old fashioned problem-solving remedies that nations have used no longer suffice. There is a world wide malaise, a sense of diminished vision in facing development problems. Unlike previous times of difficulty in which good and evil could be sharply perceived, today there is a feeling that the real problems of nations are so complex that the traditional way to running things is inadequate.

One real danger is that the world will sit back and hope for leadership in the belief that great issues summon great men. And when the man in the street thinks of this type of leadership, he generally means "charisma." The question is whether the world really needs more of the charismatic, individualistic leaders that have dominated our century. Henry Kissinger is reported to have ventured the opinion that "A society that must produce a great man in each generation to maintain its domestic or international position will doom itself." A second danger is that those

skeptical of the systems approach will--with no scientific basis for their reticence, with only a gut feeling for the realities of the policy area, and because of some deep psychological repulsion--merely condemn endeavors such as this study. No engineered system--Polaris, Apollo, Columbia--costing billions and affecting millions would be designed without making a model. Yet, national development systems are continually planned, designed and operated based on policies that have never been tested as to possible consequences. Institutions for evaluating experimental "software" such as policies must be established, just as we have laboratories for testing hardware.

Humanity is now approaching the transition from world wide growth to equilibrium. It has already started in most of the countries of the world including Lebanon. We can show it through computer printouts of model variables. We can show it mathematically using steady state analysis. What we can not do is chart the course of our human voyage through this transition. However, we suggest that the systems approach will provide the ship and computer modeling will serve as the instrument of navigation.

APPENDIX A

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*     NRDM-2 (CASE 1)
NOTE    MANUFACTURING SECTOR
L     MC.K=MC.J+(DT)(MCI.JK-MCD.JK)                                  (1)
N     MC=MCN                                                         (1.1)
NOTE    MC-MANUFACTURING CAPITAL(BIL LL)
C     MCN=8.0E9                                                      (1.2)
NOTE    MCN-MANUFACTURING CAPITAL INITIAL(BIL LL)
A     MCR.K=MC.K/MCN                                                 (2)
NOTE    MCR-MANUFACTURING CAPITAL RATIO(DIMENSIONLESS)
A     MEUCR.K=MCR.K/EUCR.K                                           (3)
NOTE    MEUCR-MANUF ELECT UTIL CAPITAL RATIO (DIMENSIONLESS)
A     MEDSM.K=TABLE(MEDSMT,MEUCR.K,0,3,1)                            (4)
T     MEDSMT=0/1/3/6                                                 (4.1)
NOTE    MEDSM-MANUF ELECT DEMAND SUPPLY MULTIPLIER(DIMENSIONLESS)
A     FMOE.K=FMOEN*MEDSM.K                                           (5)
NOTE    FMOE-FRACT MANUF OUTPUT TO ELECT (DIMENSIONLESS)
C     FMOEN=.03                                                      (5.1)
NOTE    FMOEN-FRACT MANUF OUTPUT TO ELECT NORMAL (DIMENSIONLESS)
A     MWUCR.K=MCR.K/WUCR.K                                           (6)
NOTE    MWUCR-MANUF WATER UTIL CAPITAL RATIO (DIMENSIONLESS)
A     MWDSM.K=TABLE(MWDSMT,MWUCR.K,0,3,1)                            (7)
T     MWDSMT=0/1/3/6                                                 (7.1)
NOTE    MWDSM-MANUF WATER DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
A     FMOW.K=FMOWN*MWDSM.K                                           (8)
NOTE    FMOW-FRACT MANUF OUTPUT TO WATER (DIMENSIONLESS)
C     FMOWN=.01                                                      (8.1)
NOTE    FMOWN-FRACT MANUF OUTPUT TO WATER NORMAL (DIMENSIONLESS)
A     MTCCR.K=MCR.K/TCCR.K                                           (9)
NOTE    MTCCR-MANUF TELE-COM CAPITAL RATIO (DIMENSIONLESS)
A     MCDSM.K=TABLE(MCDSMT,MTCCR.K,0,3,1)                            (10)
T     MCDSMT=0/1/3/6                                                 (10.1)
NOTE    MCDSM-MANUF COMMUN DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
A     FMOC.K=FMOCN*MCDSM.K                                           (11)
NOTE    FMOC-FRACT MANUF OUTPUT TO COMMUNICATIONS (DIMENSIONLESS)
C     FMOCN=.02                                                      (11.1)
NOTE    FMOCN-FRACT MANUF OUTPUT TO COMMUN NORMAL (DIMENSIONLESS)
A     MTFCR.K=MCR.K/TFCR.K                                           (12)
NOTE    MTFCR-MANUF TRANS FACIL CAPITAL RATIO (DIMENSIONLESS)
A     MTDSM.K=TABLE(MTDSMT,MTFCR.K,0,3,1)                            (13)
T     MTDSMT=0/1/3/6                                                 (13.1)
NOTE    MTDSM-MANUF TRANS DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
A     FMOT.K=FMOTN*MTDSM.K                                           (14)
NOTE    FMOT-FRACT MANUF OUTPUT TO TRANSPORTATION (DIMENSIONLESS)
C     FMOTN=.04                                                      (14.1)
NOTE    FMOTN-FRACT MANUF OUTPUT TO TRANS NORMAL (DIMENSIONLESS)
A     FMOIF.K=FMOE.K+FMOW.K+FMOC.K+FMOT.K                            (15)
NOTE    FMOIF-FRACT MANUF OUTPUT TO INFRASTRUCTURE (DIMENSIONLESS)
A     FMOI.K=FMOIF.K+FMOM+FMOG.K                                     (16)
NOTE    FMOI-FRACT MANUF OUTPUT TO INPUTS (DIMENSIONLESS)
C     FMOM=.35                                                       (16.1)
NOTE    FMOM-FRACT MANUF OUTPUT TO MATERIALS (DIMENSIONLESS)
A     POLR.K=MAX(LOGN(MCR.K*VPWF*MV.K/1VN),1)                        (17)
C     VPWF=2
NOTE    POLR-POLLUTION RATIO (DIMENSIONLESS)
A     PCMM.K=TABLE(PCMMT,POLR.K,0,10,2)                              (18)
T     PCMMT=.8/1.2/2/3.6/6.3/13                                      (18.1)
NOTE    PCMM-POLLUTION CONTROL MANUF MULT (DIMENSIONLESS)
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A     TPMM.K=TABLE(TPMMT,MCP.K,.5,2.0,.2)                              (19)
T     TPMMT=1.05/.95/.86/.78/.71/.65/.61/.56/.53/.51/.5                (19.1)
NOTE    TPMM-TECHNOLOGICAL PROGRESS MANUF MULT (DIMENSIONLESS)
A     MCOR.K=MCORN*PCMM.K*TPMM.K*TABLE(MLAMT,MLFO.K,0,1,.2)            (20)
C     MCORN=1.6                                                        (20.1)
T     MLAMT=1/1/1.03/1.1/1.25/1.5                                      (20.2)
NOTE    MCOR-MANUF CAPITAL OUTPUT RATIO (YEARS)
NOTE    MCORN-MANUF CAPITAL OUTPUT RATIO NORMAL (YEARS)
NOTE    MLAM-MANUF LAND AVAILABILITY MULT (DIM)
A     MO.K=MC.K/MCOR.K                                                 (21)
NOTE    MO-MANUF OUTPUT (BIL LL PER YR)
A     MP.K=MO.K*(1-FMOI.K)                                             (22)
NOTE    MP-MANUF PRODUCT (BIL LL PER YR)
R     MCD.KL=MC.K/LMC                                                  (23)
NOTE    MCD-MANUF CAPITAL DEPRECIATION (BIL LL PER YR)
C     LMC=20                                                           (23.1)
NOTE    LMC-LIFETIME MANUF CAPITAL (YEARS)
R     MCI.KL=MP.K*FMPI.K+RIM.JK                                        (24)
NOTE    MCI-MANUF CAPITAL INVESTMENT (BIL LL PER YR)
A     FMPI.K=CLIP(FMPIX,FMPIY,TIME.K,RECPER)                           (25)
C     FMPIX=.4                                                         (25.1)
C     FMPIY=.4                                                         (25.2)
C     RECPER=0                                                         (25.3)
NOTE    FMPI-FRACT MANUF PRODUCT INVESTED (DIMENSIONLESS)
NOTE    RECPER-RECONSTRUCTION PERIOD (YEARS)
R     RIM.KL=CLIP(0,RIMC,TIME.K,5)                                     (26)
C     RIMC=0                                                           (26.1)
NOTE    RIM-RECONSTRUCTION INVESTMENT IN MANUF (BIL LL PER YR)
L     NM.K=NM.J+(DT)(MA.JK)                                            (27)
N     NM=NMN                                                           (27.1)
NOTE    NM-NORMAL MANUFACTURING (ESTABLISHMENTS)
C     NMN=6000                                                         (27.2)
NOTE    NMN-NORMAL MANUFACTURING INITIALLY (ESTABLISHMENTS)
L     DM.K=DM.J-(DT)(MR.JK)                                            (28)
N     DM=DMN                                                           (28.1)
NOTE    DM-DAMAGED MANUFACTURING (ESTABLISHMENTS)
C     DMN=0                                                            (28.2)
NOTE    DMN-DAMAGED MANUFACTURING INITIALLY (ESTABLISHMENTS)
L     RM.K=RM.J+(DT)(MR.JK)                                            (29)
N     RM=RMN                                                           (29.1)
NOTE    RM-RESTORED MANUF (ESTABLISHMENTS)
C     RMN=0                                                            (29.2)
NOTE    RMN-RESTORED MANUF INITIALLY (ESTABLISHMENTS)
A     ME.K=NM.K+DM.K+RM.K                                              (30)
NOTE    ME-MANUFACTURING ESTABLISHMENTS
A     MLFO.K=ME.K*LPME/LZM                                             (31)
NOTE    MLFO-MANUF LAND FRACT OCCUPIED (DIMENSIONLESS)
C     LPME=.15                                                         (31.1)
C     LZM=4500                                                         (31.2)
NOTE    LPME-LAND PER MANUF ESTABLISHMENT (HECT PER ESTAB)
NOTE    LZM-LAND ZONED FOR MANUF (HECTARES)
A     MECM.K=TABLE(MECMT,MLFO.K,0,1,.2)                                (32)
T     MECMT=.2/.5/1.0/2.0/4.0/10.0                                     (32.1)
NOTE    MECM-MANUF ESTABLISHMENT COST MULT (DIMENSIONLESS)
A     CPME.K=CPMEN*MECM.K                                              (33)
NOTE    CPME-COST PER MANUF ESTABLISHMENT (MIL LL PER ESTAB)
C     CPMEN=1.3E6                                                      (33.1)
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NOTE   CPMEN-COST PER MANUF ESTABLISHMENT NORMAL (MIL LL PER ESTAB)
R      MA.KL=(MCI.JK-MCD.JK-MR.JK*CPME)/CPME.K                    (34)
C      CPMR=400000                                                (34.1)
NOTE   MA-MANUF ADDITIONS (ESTAB PER YR)
R      MR.KL=CLIP(0,MRP,TIME.K,RECPER)                            (35)
C      MRP=0.0                                                    (35.1)
NOTE   MR-MANUF RESTORATIONS (ESTAB PER YR)
NOTE   MRP-MANUF RESTORATIONS PROGRAMMED (ESTAB PER YR)
A      FMOG.K=CLIP(FMOGC,0,TIME.K,5)                              (36)
C      FMOGC=.05                                                  (36.1)
NOTE   FMOG-FRACT MANUF OUTPUT TO GOVT (DIMENSIONLESS)
NOTE   BUSINESS SECTOR
L      BC.K=BC.J+(DT)(BCI.JK-BCD.JK)                              (37)
N      BC=BCN                                                     (37.1)
NOTE   BC-BUSINESS CAPITAL
C      BCN=2489                                                   (37.2)
NOTE   BCN-BUSINESS CAPITAL INITIAL (BIL LL)
A      BCR.K=BC.K/BCN                                             (38)
NOTE   BCR-BUSINESS CAPITAL RATIO(DIMENSIONLESS)
A      BEUCR.K=BCR.K/EUCR.K                                       (39)
NOTE   BEUCR-BUSIN ELECT UTIL CAPITAL RATIO (DIMENSIONLESS)
A      BEDSM.K=TABLE(BEDSMT,BEUCR.K,0,3,1)                        (40)
T      BEDSMT=0/1/3/6                                             (40.1)
NOTE   BEDSM-BUSIN ELECT DEMAND SUPPLY MULT (DIMENSIONLESS)
A      FBOE.K=FBOEN*BEDSM.K                                       (41)
NOTE   FBOE-FRACT BUSIN OUTPUT TO ELECT (DIMENSIONLESS)
C      FBOEN=.025                                                 (41.1)
NOTE   FBOEN-FRACT BUSIN OUTPUT TO ELECT NORMAL (DIMENSIONLESS)
A      BWUCR.K=BCR.K/WUCR.K                                       (42)
NOTE   BWUCR-BUSIN WATER UTIL CAPITAL RATIO (DIMENSIONLESS)
A      BWDSM.K=TABLE(BWDSMT,BWUCR.K,0,3,1)                        (43)
T      BWDSMT=0/1/3/6                                             (43.1)
NOTE   BWDSM-BUSIN WATER DEMAND SUPPLY RATIO (DIMENSIONLESS)
A      FBOW.K=FBOWN*BWDSM.K                                       (44)
NOTE   FBOW-FRACT BUSIN OUTPUT TO WATER (DIMENSIONLESS)
C      FBOWN=.01                                                  (44.1)
NOTE   FBOWN-FRACT BUSIN OUTPUT TO WATER (DIMENSIONLESS)
A      BTCCR.K=BCR.K/TCCR.K                                       (45)
NOTE   BTCCR-BUSIN TELE-COM CAPITAL RATIO (DIMENSIONLESS)
A      BCDSM.K=TABLE(BCDSMT,BTCCR.K,0,3,1)                        (46)
T      BCDSMT=0/1/3/6                                             (46.1)
NOTE   BCDSM-BUSIN COMMUN DEMAND SUPPLY MULT (DIMENSIONLESS)
A      FBOC.K=FBOCN*BCDSM.K                                       (47)
NOTE   FBOC-FRACT BUSIN OUTPUT TO COMMUNICATIONS (DIMENSIONLESS)
C      FBOCN=.025                                                 (47.1)
NOTE   FBOCN-FRACT BUSIN OUTPUT TO COMMUN NORMAL (DIMENSIONLESS)
A      BTFCR.K=BCR.K/TFCR.K                                       (48)
NOTE   BTFCR-BUSIN TRANS FACIL CAPITAL RATIO (DIMENSIONLESS)
A      BTDSM.K=TABLE(BTDSMT,BTFCR.K,0,3,1)                        (49)
T      BTDSMT=0/1/3/6                                             (49.1)
NOTE   BTDSM-BUSIN TRANS DEMAND SUPPLY MULT (DIMENSIONLESS)
A      FBOT.K=FBOTN*BTDSM.K                                       (50)
NOTE   FBOT-FRACT BUSIN OUTPUT TO TRANSPORTATION (DIMENSIONLESS)
C      FBOTN=.04                                                  (50.1)
NOTE   FBOTN-FRACT BUSIN OUTPUT TO TRANS NORMAL (DIMENSIONLESS)
A      FBOIF.K=FBOE.K+FBOW.K+FBOC.K+FBOT.K                        (51)
NOTE   FBOIF-FRACT BUSIN OUTPUT TO INFRASTRUCTURE (DIMENSIONLESS)
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A     FBOI.K=FBOIF.K+FBOM+FBOG.K                                    (52)
NOTE    FBOI-FRACT BUSIN OUTPUT TO INPUTS (DIMENSIONLESS)
C     FBOM=.13                                                      (52.1)
A     BCOR.K=TABLE(BLAMT,BLFO.K,0,1,.2)*BCORN                       (53)
T     BLAMT=1.5/1/1.2/1.5/1.9/2.5                                   (53.1)
C     BCORN=2.0                                                     (53.2)
NOTE    BCOR-BUSINESS CAPITAL OUTPUT RATIO (YEARS)
A     BO.K=BC.K/BCOR.K                                              (54)
NOTE    BO-BUSINESS OUTPUT (BIL LL PER YR)
A     BP.K=BC.K*(1-FBOI.K)                                          (55)
NOTE    BP-BUSINESS PRODUCT (BIL LL PER YR)
R     BCD.KL=BC.K/LBC                                               (56)
NOTE    BCD-BUSIN CAPITAL DEPRECIATION (BIL LL PER YR)
C     LBC=25                                                        (56.1)
NOTE    LBC-LIFETIME BUSINESS CAPITAL (YEARS)
R     BCI.KL=BP.K*FBPI.K+RIB.JK                                     (57)
NOTE    BCI-BUSIN CAPITAL INVESTMENT (BIL LL PER YR)
A     FBPI.K=CLIP(FBPIX,FBPIY,TIME.K,RECPER)                        (58)
C     FBPIX=.35                                                     (58.1)
C     FBPIY=.35                                                     (58.2)
NOTE    FBPI-FRACT BUSIN PRODUCT INVESTED (DIMENSIONLESS)
R     RIB.KL=CLIP(0,RIBC,TIME.K,5)                                  (59)
C     RIBC=0                                                        (59.1)
NOTE    RIB-RECONSTRUCTION INVESTMENT IN BUSINESS
L     NB.K=NB.J+(DT)(BA.JK)                                         (60)
N     NB=NBN                                                        (60.1)
NOTE    NB-NORMAL BUSINESS (ESTABLISHMENTS)
C     NBN=30000                                                     (60.2)
NOTE    NBN-NORMAL BUSINESS INITIALLY (ESTABLISHMENTS)
L     DB.K=DB.J-(DT)(BR.JK)                                         (61)
N     DB=DBN                                                        (61.1)
NOTE    DB-DAMAGED BUSINESS (ESTABLISHMENTS)
C     DBN=0                                                         (61.2)
NOTE    DBN-DAMAGED BUSINESS INITIALLY (ESTABLISHMENTS)
L     RB.K=RB.J+(DT)(BR.JK)                                         (62)
N     RB=RBN                                                        (62.1)
NOTE    RB-RESTORED BUSINESS (ESTABLISHMENTS)
C     RBN=0                                                         (62.2)
NOTE    RBN-RESTORED BUSINESS (ESTABLISHMENTS)
A     BE.K=NB.K+DB.K+RB.K                                           (63)
NOTE    BE-BUSINESS ESTABLISHMENTS
A     BLFO.K=BE.K*LPBE/LZB                                          (64)
NOTE    BLFO-BUSINESS LAND FRACTION OCCUPIED (DIMENSIONLESS)
NOTE    LPBE-LAND PER BUSINESS ESTABLISHMENT (HECT PER ESTAB)
C     LPBE=.05                                                      (64.1)
C     LZB=3000                                                      (64.2)
NOTE    LZB-LAND ZONED PER BUSINESS (HECTARES)
A     BECM.K=TABLE(BECMT,BLFO.K,0,1,.2)                             (65)
T     BECMT=.2/.5/1/2/4/10                                          (65.1)
NOTE    BECM-BUSIN ESTAB COST MULT (DIMENSIONLESS)
A     CPBE.K=CPBEN*BECM.K                                           (66)
NOTE    CPBE-COST PER BUSIN ESTAB (MIL LL PER ESTAB)
C     CPBEN=.85                                                     (66.1)
NOTE    CPBEN-COST PER BUSIN ESTAB NORMAL (MIL LL PER ESTAB)
R     BA.KL=(BP.K*FBPI.K-BC.K/LBC)/CPBE.K                           (67)
NOTE    BA-BUSINESS ADDITIONS (ESTAB PER YR)
R     BR.KL=CLIP(0,BRP,TIME.K,RECPER)                               (68)
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C     BRP=0                                                          (68.1)
NOTE    BR-BUSIN RESTORATIONS (ESTAB PER YR)
NOTE    BRP-BUSIN RESTORATIONS PROGRAMMED (ESTAB PER YR)
A     FBOG.K=CLIP(FBOGC,.1,TIME.K,5)                                 (69)
C     FBOGC=.10                                                      (69.1)
NOTE    FBOG-FRACT BUSIN OUTPUT TO GOVT (DIMENSIONLESS)
NOTE    INFRASTRUCTURE SECTOR
L     EUC.K=EUC.J+(DT)(EUCI.JK-EUCD.JK)                              (70)
N     EUC=EUCN                                                       (70.1)
NOTE    EUC-ELECTRIC UTILITY CAPITAL (BIL LL)
C     EUCN=1.2E9                                                     (70.2)
NOTE    EUCN-ELECTRIC UTIL CAPITAL INITIAL (BIL LL)
A     EUCR.K=EUC.K/EUCN                                              (71)
NOTE    EUCR-ELECTRIC UTIL CAPITAL RATIO (DIMENSIONLESS)
A     EUO.K=MO.K*FMOE.K+BO.K*FBOE.K                                  (72)
NOTE    EUO-ELECTRIC UTIL OUTPUT (BIL LL PER YR)
A     FEUCH.K=HEO.K/TEO.K                                            (73)
NOTE    FEUCH-FRACT ELECT UTIL CAPL HYDROELECTRIC (DIMEN)
A     FEUOF.K=TABLE(FEUOFT,FEUCH.K,0,1,.5)                           (74)
T     FEUOFT=.6/.4/0                                                 (74.1)
NOTE    FEUOF-FRACT ELECT UTIL OUTPUT TO FUEL (DIMEN)
A     EUP.K=EUO.K*(1-FEUOF.K)                                        (75)
NOTE    EUP-ELECTRIC UTIL PRODUCT (BIL LL PER YR)
R     EUCD.KL=EUC.K/LEUC                                             (76)
NOTE    EUCD-ELECT UTIL CAPITAL DEPRECIATION (BIL LL PER YR)
C     LEUC=40                                                        (76.1)
NOTE    LEUC-LIFETIME ELECT UTIL CAPITAL (YEARS)
R     EUCI.KL=EUP.K*FEUPI                                            (77)
NOTE    EUCI-ELECT UTIL CAPITAL INVESTMENT (BIL LL PER YR)
C     FEUPI=.4                                                       (77.1)
NOTE    FEUPI-FRACT ELECT UTIL PRODUCT INVESTED (DIMEN)
L     WUC.K=WUC.J+(DT)(WUCI.JK-WUCD.JK)                              (78)
N     WUC=WUCN                                                       (78.1)
NOTE    WUC-WATER UTIL CAPITAL (BIL LL)
C     WUCN=1.2E9                                                     (78.2)
NOTE    WUCN-WATER UTIL CAPITAL INITIAL (BIL LL)
A     WUCR.K=WUC.K/WUCN                                              (79)
NOTE    WUCR-WATER UTIL CAPITAL RATIO (DIMEN)
A     WUO.K=MO.K*FMOW.K+BO.K*FBOW.K                                  (80)
NOTE    WUO-WATER UTIL OUTPUT (BIL LL PER YR)
A     WUP.K=WUO.K*(1-FWUOI)                                          (81)
NOTE    WUP-WATER UTIL PRODUCT (BIL LL PER YR)
C     FWUOI=.05                                                      (81.1)
NOTE    FWUOI-FRACT WATER UTIL OUTPUT TO INPUTS (DIMEN)
A     WDSR.K=DSWC.K/DSWS.K                                           (82)
NOTE    WDSR-WATER DEMAND SUPPLY RATIO (DIMEN)
A     EWUIM.K=TABLE(EWUIMT,WDSR.K,0,4,.4)                            (83)
T     EWUIMT=1/1/.9/.75/.55/.3/.1/.05/.02/.01/.01                    (83.1)
NOTE    EWUIM-EFFICIENCY WATER UTIL INVESTMENT MULT (DIMEN)
R     WUCD.KL=WUC.K/LWUC                                             (84)
NOTE    WUCD-WATER UTIL CAPITAL DEPRECIATION (BIL LL PER YR)
C     LWUC=50                                                        (84.1)
NOTE    LWUC-LIFETIME WATER UTIL CAPITAL (YEARS)
R     WUCI.KL=WUP.K*FWUPI*EWUIM.K                                    (85)
NOTE    WUCI-WATER UTIL CAPITAL INVESTMENT (BIL LL PER YR)
C     FWUPI=.4                                                       (85.1)
NOTE    FWUPI-FRACT WATER UTIL PRODUCT INVESTED (DIMEN)
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L     TCC.K=TCC.J+(DT)(TCCI.JK-TCCD.JK)                              (86)
N     TCC=TCCN                                                       (86.1)
NOTE    TCC-TELE-COMMUNICATIONS CAPITAL (BIL LL)
C     TCCN=1.5E9                                                     (86.2)
NOTE    TCCN-TELE-COMMUN CAPITAL INITIAL (BIL LL)
A     TCCR.K=TCC.K/TCCN                                              (87)
NOTE    TCCR-TELE-COMMUN CAPITAL RATIO (DIMEN)
A     TCO.K=MO.K*FMOC.K+BO.K*FBOC.K                                  (88)
NOTE    TCO-TELE-COMMUN OUTPUT (BIL LL PER YR)
A     TCP.K=TCO.K*(1-FTCOI)                                          (89)
NOTE    TCP-TELE-COMMUN PRODUCT (BIL LL PER YR)
C     FTCOI=.3                                                       (89.1)
NOTE    FTCOI-FRACT TELE-COMMUN OUTPUT TO INPUTS (DIMEN)
R     TCCD.KL=TCC.K/LTCC                                             (90)
NOTE    TCCD-TELE-COMMUN CAPITAL DEPRECIATION (BIL LL PER YR)
C     LTCC=30                                                        (90.1)
NOTE    LTCC-LIFETIME TELE-COMMUN CAPITAL (YEARS)
R     TCCI.KL=TCP.K*FTCPI+RITC.JK                                    (91)
NOTE    TCCI-TELECOMMUN CAPITAL INVESTMENT (BIL LL PER YR)
C     FTCPI=.4                                                       (91.1)
NOTE    FTCPI-FRACT TELECOMMUN PRODUCT INVESTED (DIMEN)
R     RITC.KL=CLIP(0,RITCC,TIME.K,5)                                 (92)
C     RITCC=0                                                        (92.1)
NOTE    RITC-RECONSTRUCTION INVESTMENT IN TELECOMMUN (BIL LL PER YR)
L     ITF.K=ITF.J+(DT)(ITFI.JK-ITFD.JK)                              (93)
N     ITF=ITFN                                                       (93.1)
NOTE    ITF-INTERNATIONAL TRANSPORT FACILITIES (BIL LL)
C     ITFN=1.5E9                                                     (93.2)
NOTE    ITFN-INTL TRANSPORT FACIL INITIAL (BIL LL)
A     ITO.K=(MO.K*FMOT.K+BO.K*FBOT.K)*FIT                            (94)
NOTE    ITO-INTL TRANSPORT OUTPUT (BIL LL)
C     FIT=.5                                                         (94.1)
NOTE    FIT-FRACT IN INTL TRANSPORT (DIMEN)
A     ITP.K=ITO.K*(1-FITOI)                                          (95)
NOTE    ITP-INTL TRANSPORT PRODUCT (BIL LL PER YR)
C     FITOI=.2                                                       (95.1)
NOTE    FITOI-FRACT INTL TRANSPORT OUTPUT TO INPUTS
R     ITFD.KL=ITF.K/LITF                                             (96)
NOTE    ITFD-INTL TRANSPORT FACIL DEPRECIATION (BIL LL PER YR)
C     LITF=25                                                        (96.1)
NOTE    LITF-LIFETIME INTL TRANSPORT FACIL (YEARS)
R     ITFI.KL=ITP.K*FITPI+RIIT.JK                                    (97)
NOTE    ITFI-INTERNATIONAL TRANS FACIL INVESTMENT (BIL LL PER YR)
C     FITPI=.4                                                       (97.1)
NOTE    FITPI-FRACT INTL TRANSPORT PRODUCT INVESTED
R     RIIT.KL=CLIP(0,RIITC.TIME.K,5)                                 (98)
C     RIITC=0                                                        (98.1)
NOTE    RIIT-RECONSTRUCTION INVESTMENT IN INTL TRANSPORT (BIL LL PER YR)
L     LTF.K=LTF.J+(DT)(LTFI.JK-LTFD.JK)                              (99)
N     LTF=LTFN                                                       (99.1)
NOTE    LTF-LAND TRANSPORT FACILITIES (BIL LL)
C     LTFN=4.5E9                                                     (99.2)
NOTE    LTFN-LAND TRANSPORT FACIL INITIAL (BIL LL)
A     LTO.K=(MO.K*FMOT.K+BO.K*FBOT.K)*FLT                            (100)
NOTE    LTO-LAND TRANSPORT OUTPUT (BIL LL PER YR)
C     FLT=.5                                                         (100.1)
NOTE    FLT-FRACT IN LAND TRANSPORT (DIMEN)
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A     LTP.K=LTD.K*(1-FLTDI)                                          (101)
NOTE    LTP-LAND TRANSPORT PRODUCT (BIL LL PER YR)
C     FLTDI=.5                                                       (101.1)
NOTE    FLTDI-FRACT LAND TRANSPORT OUTPUT TO INPUTS (DIMEN)
R     LTFD.KL=LTF.K/LLTF                                             (102)
NOTE    LTFD-LAND TRANSPORT FACIL DEPRECIATION (BIL LL PER YR)
C     LLTF=75                                                        (102.1)
NOTE    LLTF-LIFETIME LAND TRANSPORT FACIL (YEARS)
R     LTFI.KL=LTP.K*FLTPI+RILT.JK                                    (103)
NOTE    LTFI-LAND TRANSPORT FACIL INVESTMENT (BIL LL PER YR)
C     FLTPI=.4                                                       (103.1)
NOTE    FLTFI-FRACT LAND TRANSPORT FACIL INVESTED (DIMEN)
R     RILT.KL=CLIP(0,RILTC,TIME.K,5)                                 (104)
C     RILTC=0                                                        (104.1)
NOTE    RILT-RECONSTRUCTION INVESTMENT IN LAND TRANSPORT (BIL LL PER YR)
A     TFCR.K=(ITF.K+LTF.K)/(ITFN+LTFN)                               (105)
NOTE    TFCR-TRANS FACIL CAPITAL RATIO (DIMEN)
NOTE    MANPOWER SECTOR
A     JPMCU.K=TABLE(JPMCUT,MCR.K,0,20,2)                             (106)
T     JPMCUT=.28/.22/.17/.13/.10/.08/.07/.065/.062/.06/.06           (106.1)
NOTE    JPMCU-JOBS PER MANUF. CAPITAL UNIT (PERSONS/LL E4)
A     JIM.K=JPMCU.K*MC.K/10000                                       (107)
NOTE    JIM-JOBS IN MANUFACTURING (PERSONS)
A     FMPGTP.K=CLIP(FMPGX,FMPGY,TIME.K,RECPER)                       (108)
C     FMPGX=.05                                                      (108.1)
C     FMPGY=.05                                                      (108.2)
NOTE    FMPGTP-FRACT. MANUF. PRODUCT GOVT. TRANSFER PAYMENT (DIM.)
A     GDPPWM.K=MP.K*(1-FMPI.K-FMPGTP.K)/JIM.K                        (109)
NOTE    GDPPWM-G.D.P. PER WORKER IN MANUF (LL/YR-PERSON)
A     JPBCU.K=TABLE(JPBCUT,BCR.K,0,20,2)                             (110)
T     JPBCUT=.225/.175/.135/.105/.085/.075/.07/.07/.07/.07/.07       (110.1)
NOTE    JPBCU-JOBS PER BUSINESS CAPITAL UNIT (PERSONS/LL E4)
A     JIB.K=JPBCU.K*BC.K/10000                                       (111)
NOTE    JIB-JOBS IN BUSINESS (PERSONS)
A     FBPGTP.K=CLIP(FBPGX,FBPGY,TIME.K,RECPER)                       (112)
C     FBPGX=.1                                                       (112.1)
C     FBPGY=.1                                                       (112.2)
NOTE    FBPGTP-FRACT. BUSIN. PRODUCT GOVT. TRANSFER PAYMENT (DIM.)
A     GDPPWB.K=BP.K*(1-FBPI.K-FBPGTP.K)/JIB.K                        (113)
NOTE    GDPPWB-G.D.P. PER WORKER IN BUSIN. (LL/YR-PERSON)
A     JPEUCU.K=TABLE(JEUCUT,EUCR.K,0,2,4)                            (114)
T     JEUCUT=.75/.55/.45/.4/.37/.35                                  (114.1)
NOTE    JPEUCU-JOBS PER ELECT UTIL CAPITAL UNIT (PERSONS/LL E5)
A     JIEU.K=JPEUCU.K*EUC.K/100000                                   (115)
NOTE    JIEU-JOBS IN ELECTRIC UTILITIES (PERSONS)
A     GDPWEU.K=EUP.K*(1-FEUPI)/JIEU.K                                (116)
NOTE    GDPWEU-G.D.P. PER WORKER IN ELECT UTIL (LL/YR-PERSON)
NOTE    FEUPI-FRACT ELECT UTIL PROD INVESTED (DIM)
A     JPWUCU.K=TABLE(JWUCUT,WUCR.K,0,2),4)                           (117)
T     JWUCUT=.46/.38/.32/.28/.26/.25                                 (117.1)
NOTE    JPWUCU-JOBS PER WATER UTIL CAPITAL UNIT (PERSONS/LL E5)
A     JIWU.K=JPWUCU.K*WUC.K/10000)                                   (118)
NOTE    JIWU-JOBS IN WATER UTILITIES (PERSONS)
A     GDPWWU.K=WUP.K*(1-FWUPI)/JIWU.K                                (119)
NOTE    GDPWWU-G.D.P. PER WORKER IN WATER UTIL (LL/YR-PERSON)
A     JPTCCU.K=TABLE(JTCCUT,TCCR.K,0,2),4)                           (120)
T     JTCCUT=1.05/.85/.7/.6/.55/.5                                   (120.1)
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NOTE   JPTCCU-JOBS PER TELE-COM CAPITAL UNIT (PERSONS/LL $5)
A      JITC.K=JPTCCU.K*TCC.K/100000                                    (121)
NOTE   JITC-JOBS IN TELE-COMMUNICATIONS (PERSONS)
A      GDPWTC.K=TCP.K*(1-FTCPI)/JITC.K                                 (122)
NOTE   GDPWTC-G.D.P. PER WORKER IN TELE-COM(LL/YR-PERSON)
A      JPPTCU.K=TABLE(JITCUT,ITF.K/ITFN,0,20,4)                        (123)
T      JITCUT=.75/.55/.45/.4/.37/.35                                   (123.1)
NOTE   JPITCU-JOBS PER INTL TRANS CAPITAL UNIT (PERSONS/LL $5)
A      JITF.K=JPPTCU.K*ITF.K/100000                                    (124)
NOTE   JITF-JOBS IN INTL TRANS FACILITIES (PERSONS)
A      GDPWIT.K=ITP.K*(1-FITPI)/JITF.K                                 (125)
NOTE   GDPWIT-G.D.P. PER WORKER IN INTL TRANS (LL/YR-PERSON)
A      JPLTCU.K=TABLE(JLTCUT,LTF.K/LTFN,0,20,4)                        (126)
T      JLTCUT=.21/.17/.14/.12/.11/.1                                   (126.1)
NOTE   JPLTCU-JOBS PER LAND TRANSPORT CAPITAL UNIT (PERSONS/LL $5)
A      JLTF.K=JPLTCU.K*LTF.K/100000                                    (127)
NOTE   JLTF-JOBS IN LAND TRANS FACILITIES (PERSONS)
A      GDPWLT.K=LTP.K*(1-FLTPI)/JLTF.K                                 (128)
NOTE   GDPWLT-G.D.P. PER WORKER IN LAND TRANS (LL/YR-PERSON)
A      UCGDP.K=EUP.K+WUP.K                                             (129)
NOTE   UCGDP-UTILITIES CONTRIBUTION TO G.D.P. (BIL LL PER YR)
A      IFCGDP.K=TCP.K+ITP.K+LTP.K                                      (130)
NOTE   IFCGDP-INFRASTRUCTURE CONTRIB TO G.D.P. (BIL LL PER YR)
A      CSGDP.K=MP.K+SP.K+UCGDP.K+IFCGDP.K+GSCGDP.K                     (131)
NOTE   CSGDP-CONSTRUCTION SERVING G.D.P. (BIL LL PER YR)
A      CP.K=CSGDP.K*AFPI*AFIP*(1-FCCI)                                 (132)
C      AFPI=.4                                                         (132.1)
C      AFIP=.4                                                         (132.2)
C      FCCI=.5                                                         (132.3)
NOTE   CP-CONSTRUCTION PRODUCT (BIL LL PER)
NOTE   AFPI-AVER FRACT PRODUCT INVESTED (DIM)
NOTE   AFIP-AVER FRACT INVESTMENT IN PLANT (DIM)
NOTE   FCCI-FRACT CONSTRUCTION OUTPUT TO INPUTS (DIM)
A      CO.K=CP.K/(1-FCCI)                                              (133)
NOTE   CO-CONSTRUCTION OUTPUT (BIL LL PER YR)
A      CC.K=CO.K*CCOR                                                  (134)
C      CCOR=1.0                                                        (134.1)
NOTE   CC-CONSTRUCTION CAPITAL (BIL LL)
NOTE   CCOR-CONSTRUCTION CAPITAL OUTPUT RATIO (YEARS)
A      JIC.K=CC.K*JPCCU                                                (135)
C      JPCCU=.3E-5                                                     (135.1)
NOTE   JIC-JOBS IN CONSTRUCTION (PERSONS)
NOTE   JPCCU-JOBS PER CONSTRUCTION CAPITAL UNIT (PERSONS/LL $5)
A      GDPPWC.K=CP.K*(1-FCPI)/JIC.K                                    (136)
C      FCPI=.4                                                         (136.1)
NOTE   GDPPWC-G.D.P. PER WORKER IN CONSTR (LL/YR-PERSON)
NOTE   FCPI-FRACT CONSTRUCTION PROD INVESTED (DIM)
A      NAJ.K=JIM.K+JIB.K+JIEU.K+JIWU.K+JITC.K+JITF.K+JLTF.K+JIGS.K+JIC.K
NOTE   NAJ-NON-AGRICULTURAL JOBS (PERSONS)
NOTE   GOVERNMENT SERVICES SECTOR
L      UPEF.K=UPEF.J+(DT)(UPEFI.JK-UPEFD.JK)                           (138)
N      UPEF=UPEFN                                                      (138.1)
C      UPEFN=.8E9                                                      (138.2)
NOTE   UPEF-URBAN PUBLIC EDUC FACIL (LL)
L      RPEF.K=RPEF.J+(DT)(RPEFI.JK-RPEFD.JK)                           (139)
N      RPEF=RPEFN                                                      (139.1)
C      RPEFN=.2E9                                                      (139.2)
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NOTE   RPEF-RURAL PUBLIC EDUC FACIL (LL)
A      PEO.K=PEF.K/TABLE(PECORT,PEF.K/PEFN,0,20,2)                    (140)
T      PECORT=3.5/4.5/4.6/5/5.2/5.5/6/7/8.5/10/12                     (140.1)
C      PEFN=1.0E9                                                     (140.2)
NOTE   PECOR-PUBLIC EDUC CAPITAL OUTPUT RATIO (YEARS)
NOTE   PEFN-PUBLIC EDUCATION FACIL INITIAL (BIL LL)
S      FPES.K=PEP.K/PEO.K                                             (141)
NOTE   FPES-FRACT PUBLIC EDUC SUBSIDIZED
NOTE   PEO-PUBLIC EDUC OUTPUT (BIL LL PER YR)
A      GP.K=MO.K*FMDG.K+BC.K*FBDG.K                                   (142)
NOTE   GP-GOVERNMENT PRODUCT (BIL LL PER YR)
A      PEP.K=GP.K*FGPPE                                               (143)
C      FGPPE=.15                                                      (143.1)
NOTE   PEP-PUBLIC EDUCATION PRODUCT (BIL LL PER YR)
NOTE   FGPPE-FRACT GOVT PRODUCT TO PUBLIC EDUCATION (DIM)
R      UPEFD.KL=UPEF.K/LPEF                                           (144)
C      LPEF=25                                                        (144.1)
NOTE   UPEFD-URBAN PUBLIC EDUC FACIL DEPRECIATION (LL/YR)
NOTE   LPEF-LIFETIME PUBLIC EDUC FACIL (YR)
R      RPEFD.KL=RPEF.K/LPEF                                           (145)
NOTE   LPEF-LIFETIME PUBLIC EDUC FACIL (YEARS)
A      JPPECU.K=TABLE(JPECUT,PEF.K/PEFN,0,20,4)                       (146)
T      JPECUT=1.02/.94/.88/.84/.82/.8                                 (146.1)
NOTE   JPPECU-JOBS PER PUBLIC EDUC CAPITAL UNIT (PERSONS/LL $)
A      JIPE.K=JPPECU.K*PEF.K/100000                                   (147)
NOTE   JIPE-JOBS IN PUBLIC EDUCATION (PERSONS)
A      GDPWPU.K=PEP.K*(1-FPEPI)/JIPE.K                                (148)
C      FPEPI=.4                                                       (148.1)
NOTE   GDPWPU-G.D.P. PER WORKER PUBLIC EDUC (LL/YR-PERSON)
NOTE   FPEPI-FRACT PUBLIC EDUC PRODUCT INVESTED (DIM)
R      UPEFI.KL=PEP.K*FPEPI*FIUPE                                     (149)
C      FIUPE=.8                                                       (149.1)
NOTE   UPEFI-URBAN PUBLIC EDUC FACIL INVESTMENT (LL/YR)
NOTE   FIUPE-FRACT INVESTMENT URBAN PUBLIC EDUC (DIM)
R      RPEFI.KL=PEP.K*FPEPI*(1-FIUPE)                                 (150)
NOTE   RPEFI-RURAL PUBLIC EDUC FACIL INVESTMENT (LL/YR)
A      PEF.K=UPEF.K+RPEF.K                                            (151)
NOTE   PEF-PUBLIC EDUCATION FACILITIES (BIL LL)
A      PHO.K=PHF.K/TABLE(PHCORT,PHF.K/PHFN,0,20,2)                    (152)
T      PHCORT=2.5/3.5/4.1/4.5/4.9/5.5/6/7/8.5/10/12                   (152.1)
C      PHFN=1.0E9                                                     (152.2)
NOTE   PHCOR-PUBLIC HEALTH CAPITAL OUTPUT RATIO (YEARS)
NOTE   PHFN-PUBLIC HEALTH FACIL INITIAL (BIL LL)
S      FPHS.K=PHP.K/PHO.K                                             (153)
NOTE   FPHS-FRACT PUBLIC HEALTH SUBSIDIZED
NOTE   PHO-PUBLIC HEALTH OUTPUT (BIL LL PER YR)
A      PHP.K=GP.K*FGPPH                                               (154)
C      FGPPH=.2                                                       (154.1)
NOTE   PHP-PUBLIC HEALTH PRODUCT (BIL LL PER YR)
NOTE   FGPPH-FRACT GOVT PRODUCT TO PUBLIC HEALTH (DIM)
L      UPHF.K=UPHF.J+(DT)(UPHFI.JK-UPHFD.JK)                          (155)
N      UPHF=UPHFN                                                     (155.1)
C      UPHFN=.8E9                                                     (155.2)
NOTE   UPHF-URBAN PUBLIC HEALTH FACIL (LL)
L      RPHF.K=RPHF.J+(DT)(RPHFI.JK-RPHFD.JK)                          (156)
N      RPHF=RPHFN                                                     (156.1)
C      RPHFN=.259                                                     (156.2)
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NOTE    RPHF-RURAL PUBLIC HEALTH FACIL (LL)
A       JPPHCU.K=TABLE(JPHCUT,PHF.K/PHFN,0,20,+)                    (157)
T       JPHCUT=1.02/.94/.88/.84/.82/.8                              (157.1)
NOTE    JPPHCU-JOBS PER PUBLIC HEALTH CAPITAL UNIT (PERSON/LL E5)
A       JIPH.K=JPPHCU.K*PHF.K/100000                                (158)
NOTE    JIPH-JOBS IN PUBLIC HEALTH (PERSONS)
A       GDPWPH.K=PHP.K*(1-FPHPI)/JIPH.K                             (159)
C       FPHPI=.4                                                    (159.1)
NOTE    GDPWPH-G.D.P. PER WORKER IN PUBLIC HEALTH (LL/YR-PERSON)
NOTE    FPHPI-FRACT PUBLIC HEALTH PRODUCT INVESTED (DIM)
A       PHF.K=UPHF.K+RPHF.K                                         (160)
NOTE    PHF-PUBLIC HEALTH FACIL (LL)
R       UPHFI.KL=PHP.K*FPHPI*FIUPH                                  (161)
C       FIUPH=.8                                                    (161.1)
NOTE    UPHFI-URBAN PUBLIC HEALTH FACIL INVESTMENT (LL/YR)
NOTE    FIUPH.FRACT INVESTMENT URBAN PUBLIC
R       RPHFI.KL=PHP.K*FPHPI*(1-FIUPH)                              (162)
NOTE    RPHFI-RURAL PUBLIC HEALTH FACIL INVESTED (LL/YR)
R       UPHFD.KL=UPHF.K/LPHF                                        (163)
C       LPHF=15                                                     (163.1)
NOTE    UPHFD-URBAN PUBLIC HEALTH FACIL DEPRECIATION
NOTE    LPHF-LIFETIME PUBLIC HEALTH FACILITIES (YR)
R       RPHFD.KL=RPHF.K/LPHF                                        (164)
NOTE    RPHFD-RURAL PUBLIC HEALTH FACIL DEPRECIATION
NOTE    LPHF-LIFETIME PUBLIC HEALTH FACIL (YEARS)
A       LIHO.K=LID.K*RENT.K                                         (165)
NOTE    LIHO-LOW INCOME HOUSING OUTPUT (BIL LL PER YR)
A       LIHP.K=GP.K*FGPLIH+LIHO.K*(1-FRTI)                          (166)
C       FRTI=.5                                                     (166.1)
C       FGPLIH=.2                                                   (166.2)
NOTE    LIHP-LOW INCOME HOUSING PRODUCT (BIL LL PER YR)
NOTE    FRTI-FRACT RENT TO INPUTS
NOTE    FGPLIH-FRACT GOVT PROD INVESTE) IN LOW INCOME HOUSING (DIM)
R       RILIH.KL=CLIP(0,RILIHC,TIME.K,5)                            (167)
C       RILIHC=0                                                    (167.1)
NOTE    RILIH-RECONSTRUCTION INVESTMENT IN LOW INCOME HOUSING (BIL LL PER
A       PAP.K=GP.K*FGPPA                                            (168)
C       FGPPA=.45                                                   (168.1)
NOTE    PAP-PUBLIC ADMINISTRATION PRODUCT (BIL LL PER YR)
NOTE    FGPPA-FRACT GOVT PROD TO PUBLIC ADMIN (DIM)
A       JIPA.K=GP.K*JPGPCU                                          (169)
C       JPGPCU=1.0E-5                                               (169.1)
NOTE    JIPA-JOBS IN PUBLIC ADMINISTRATION (PERSONS)
NOTE    JPGPCU-JOBS PER GOVT PROD CAPITAL UNIT (PERSONS/LL E5)
A       JIGS.K=JIPE.K+JIPH.K+JIPA.K                                 (170)
NOTE    JIGS-JOBS IN GOVT SERVICES (PERSONS)
A       GSCGDP.K=PEP.K+PHP.K+LIHP.K+PAP.K                           (171)
NOTE    GSCGDP-GOVT. SERVICE CONTRIB TO G.D.P. (BIL LL PER YR)
NOTE    AGRICULTURAL SECTOR
L       IF.K=IF.J+(DT)(IFI.JK-IFD.JK)                               (172)
N       IF=IFN                                                      (172.1)
NOTE    IF-IRRIGATION FACILITIES (BIL LL)
C       IFN=.759                                                    (172.2)
NOTE    IFN-IRRIGATION FACILITIES INITIAL (BIL LL)
L       NICL.K=NICL.J-(DT)(ILDR.JK+LCR.JK)                          (173)
N       NICL=NICLN                                                  (173.1)
NOTE    NICL-NON-IRRIGATED CULTIVATABLE LAND (HECTARES)
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C    NICLN=270000                                                    (173.2)
NOTE   NICLN-NON-IRRI CULTIVATABLE LAND INITIAL (HECTARES)
L    ICL.K=ICL.J+(DT)(ILDR.JK)                                       (174)
N    ICL=ICLN                                                        (174.1)
NOTE   ICL-IRRIGATED CULTIVATABLE LAND (HECTARES)
C    ICLN=90000                                                      (174.2)
NOTE   ICLN-IRRIGATED CULTIVATABLE LAND INITIAL (HECTARES)
L    UL.K=UL.J+(DT)(LCCR.JK)                                         (175)
N    UL=ULN                                                          (175.1)
NOTE   UL-URBAN LAND (HECTARES)
C    ULN=10000                                                       (175.2)
NOTE   ULN-URBAN LAND INITIAL (HECTARES)
L    AC.K=AC.J+(DT)(ACI.JK-ACD.JK)                                   (176)
N    AC=ACN                                                          (176.1)
NOTE   AC-AGRICULTURAL CAPITAL (BIL LL)
C    ACN=1.4E9                                                       (176.2)
NOTE   ACN-AGRICULTURAL CAPITAL INITIAL (BIL LL)
A    CNILR.K=AC.K/(NICL.K+RWIL*ICL.K)                                (177)
C    RWIL=2                                                          (177.1)
NOTE   CNILR-CAPITAL NON-IRRI LAND RATIO (LL PER HECT)
NOTE   RWIL-RELATIVE WEIGHT OF IRRI LAND (DIM)
A    ACILR.K=AC.K/(ICL.K+NICL.K/RWIL)                                (178)
NOTE   ACILR-AG CAPITAL IRRI LAND RATIO (LL PER HECT)
A    FNICLR.K=NICL.K/(NICLN+ICLN)                                    (179)
NOTE   FNICLR-FRACT NON-IRRI CULT LAND REMAINING (DIM)
A    CILR.K=ACILR.K+IFLN                                             (180)
C    IFLN=7778                                                       (180.1)
NOTE   CILR-CAPITAL IRRI LAND RATIO (LL PER HECT)
NOTE   IFLN-IRRI FACILITIES PER LAND INITIAL (LL PER HECT)
A    RCNILR.K=CNILR.K/CNILRN                                         (181)
C    CNILRN=3111                                                     (181.1)
NOTE   RCNILR-RELATIVE CAPL NON-IRRI LAND RATIO (DIM)
NOTE   CNILRN-CAPITAL NON-IRRI LAND RATIO INITIAL (LL PER HECT)
A    RCILR.K=CILR.K/CILRN                                            (182)
C    CILRN=14000                                                     (182.1)
NOTE   RCILR-RELATIVE CAPITAL IRRI LAND RATIO (DIM)
NOTE   CILRN-CAPITAL IRRI LAND RATIO INITIAL (LL PER HECT)
A    CYMNIL.K=TABLE(YMNILT,RCNILR.K,0,10,2)                          (183)
T    YMNILT=0/2/2.5/2.9/3/3                                          (183.1)
NOTE   CYMNIL-CAPL YIELD MULTIPLER NON-IRRI LAND (DIM)
A    CYMIL.K=TABLE(CYMILT,RCILR.K,0,1),2)                            (184)
T    CYMILT=0/2/3.5/4.5/5/5                                          (184.1)
NOTE   CYMIL-CAPL YIELD MULTIPLIER IRRIGATED LAND (DIM)
A    NILY.K=NILYN*CYMNIL.K                                           (185)
C    NILYN=1.0                                                       (185.1)
NOTE   NILYN-NON IRRI LAND YIELD NORMAL (VEG EQUIV TONS/HECT-YR)
A    ILY.K=ILYN*CYMIL.K                                              (186)
C    ILYN=6.0                                                        (186.1)
NOTE   ILYN-IRRIGATED LAND YIELD NORMAL (VEG EQUIV TONS/HECT-YR)
A    FP.K=NILY.K*NICL.K+ILY.K*ICL.K                                  (187)
NOTE   FP-FOOD PRODUCTION (THOUSAND VEG EQUIV TONS/HECT-YR)
A    ILDCM.K=TABLE(ILDCMT,FNICLR.K,0,1,.25)                          (188)
T    ILDCMT=20/5/2/1/.5                                              (188.1)
NOTE   ILDCM-IRRI LAND DEVELOPMENT COST MULT (DIM)
A    ILDC.K=(IFLN+ICCN)*ILDCM.K                                      (189)
C    ICCN=7778                                                       (189.1)
NOTE   ILDC-IRRI LAND DEVELOPMENT COSTS (LL PER HECT)
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NOTE   ICCN-IRRI CONSTRUCTION COSTS INITIAL (LL PER HECT)
A      NAGDP.K=LSGDP.K+CP.K                                          (189)
NOTE   NAGDP-NON AGRICULTURE G.D.P. (BIL LL PER YR)
A      GBI.K=GTP.K*FGTPIM.K*FGTPIN+FPI.K                             (190)
C      FGTPIN=.08                                                    (191.2)
NOTE   GBI-GOVT BUDGET TO IRRIGATION (BIL LL PER YR)
NOTE   FGTPIN-FRACT GOVT TRANSFER PAYMENTS TO IRRI NORMAL (DIM)
R      ILDR.KL=GBI.K/ILDC.K                                          (192)
NOTE   ILDR-IRRI LAND DEVELOPMENT RATE (HECT PER YR)
A      ULR.K=TABLE(ULRT,NAGDP.K,0,150E9,15E9)                        (193)
T  ULRT=0/16000/24000/28000/30000/31000/31000/31000/31000/31000/31000
NOTE   ULR-URBAN LAND REQUIRED (THOUSANDS OF HECTARES)
R      LCCR.KL=DELAY1(LCR.JK,ULDT)                                   (194)
R      LCR.KL=(ULR.K-UL.K)*FLPPY                                     (194.1)
C      FLPPY=.25                                                     (194.2)
C      ULDT=4                                                        (194.3)
NOTE   LCCR-LAND CONVERSION COMPLETION RATE (HA/YR)
NOTE   LCR-LAND CONVERSION RATE (HA/YR)
NOTE   FLPPY-FRACT LAND PROGRAMMED PER YEAR (1/YR)
NOTE   ULDT-URBAN LAND DEVELOPMENT TIME (YEARS)
NOTE   LCR-LAND CONVERSION RATE (HECT PER YR)
NOTE   ULDT-URBAN LAND DEVELOPMENT TIME (YEARS)
R      IFD.KL=IF.K/LIF                                               (195)
C      LIF=35                                                        (195.1)
NOTE   IFD-IRRI FACILITIES DEPRECIATION (BIL LL PER YR)
NOTE   LIF-LIFETIME IRRI FACILITIES (YEARS)
R      IFI.KL=GBI.K                                                  (196)
NOTE   IFI-IRRI FACILITIES INVESTMENT (BIL LL PER YR)
A      FPC.K=FP.K/NP.K                                               (197)
NOTE   FPC-FOOD PER CAPITA (THOUS VEG EQUIV TONS / YR-PERSON)
A      FGTPIM.K=TABLE(FGPIMT,FPC.K/FPCN,0,4,1)                       (198)
T      FGPIMT=2/1.5/1/.6/.5                                          (198.1)
C      FPCN=.27                                                      (198.2)
NOTE   FGTPIM-FRACT GOVT TRANSFER PAYMENTS TO IRRI MULT (DIM)
A      AO.K=FP.K*POF                                                 (199)
C      POF=1000                                                      (199.1)
NOTE   AO-AGRICULTURAL OUTPUT (BIL LL PER YR)
NOTE   POF-PRICE OF FOOD (LL PER TON)
A      AP.K=AO.K*(1-FAOI)                                            (200)
C      FAOI=.3                                                       (200.1)
NOTE   AP-AGRICULTURAL PRODUCT (BIL LL PER YR)
NOTE   FAOI-FRACT AG OUTPUT TO INPUTS (DIM)
R      ACD.KL=AC.K/LAC                                               (201)
C      LAC=20                                                        (201.1)
NOTE   ACD-AG CAPITAL DEPRECIATION (BIL LL PER YR)
NOTE   LAC-LIFETIME AG CAPITAL (YEARS)
R      ACI.KL=AP.K*FAPI                                              (202)
C      FAPI=.2                                                       (202.1)
NOTE   ACI-AG CAPITAL INVESTMENT (BIL LL PER YR)
NOTE   FAPI-FRACT AG PRODUCT INVESTED (DIM)
A      AL.K=NICL.K+ICL.K                                             (203)
NOTE   AL-AGRICULTURAL LAND (HECTARES)
A      RACLR.K=(AC.K/ALN)/(AL.K/ALN)                                 (204)
C      ALN=360000                                                    (204.1)
NOTE   RACLR-RELATIVE AG CAPL LAND RATIO (DIM)
NOTE   ALN-AG LAND INITIAL (HECTARES)
A      JPH.K=TABLE(JPHT,RACLR.K,0,10,2)                              (205)
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T    JPHT=.45/.35/.3/.27/.25/.25                                    (205.1)
NOTE   JPH-JOBS PER HECTARE
A    JIF.K=JPH.K*AL.K                                               (206)
NOTE   JIF-JOBS IN FARMING
A    GDPWF.K=AP.K*(1-FAPI)/JIF.K                                    (207)
NOTE   GDPWF-G.D.P. PER WORKER IN FARMING (LL/YR-PERSON)
NOTE   POPULATION SECTOR
A    IRP.K=AC.K*FAOIR                                               (209)
C    FAOIR=.1                                                       (209.1)
NOTE   IRP-IRRIGATION PRODUCT (BIL LL PER YR)
NOTE   FAOIR-FRACT AG OUTPUT TO IRRIGATION (DIM)
A    JPICU.K=TABLE(JPICUT,IF.K/IFN,0,.4,.4)                         (210)
T    JPICUT=.37/.25/.21/.18/.15/.13/.115/.105/.1/.1/.1              (210.1)
NOTE   JPICU-JOBS PER IRRIGATION CAPITAL UNIT (PERSONS/LL E5)
A    JII.K=JPICU.K*IF.K/100000                                      (211)
NOTE   JII-JOBS IN IRRIGATION (PERSONS)
A    GDPPWI.K=IRP.K/JII.K                                           (212)
NOTE   GDPPWI-G.D.P. PER WORKER IN IRRIGATION (LL PER YR PER PERSON)
A    AJPACU.K=TABLE(AJACUT,AC.K/ACN,0,10,2)                         (213)
T    AJACUT=.2/.15/.13/.11/.1/.1                                    (213.1)
NOTE   AJPACU-ADDITIONAL JOBS PER AG CAPITAL UNIT (PERSONS/LL E5)
A    JIAC.K=AJPACU.K*AC.K/100000                                    (214)
NOTE   JIAC-JOBS IN AG CAPITAL (PERSONS)
A    TARJ.K=JIF.K+JII.K+JIAC.K                                      (215)
NOTE   TARJ-TOTAL AG RELATED JOBS (PERSONS)
A    TAP.K=AP.K+IRP.K                                               (216)
NOTE   TAP-TOTAL AGRICULTURAL PRODUCT (BIL LL PER YR)
A    RPI.K=(MO.K+BC.K)*(FCF.K-SCF.K)                                (217)
A    FCF.K=CLIP(FMOGC+FBOGC-.15,0,TIME.K,5)                         (217.1)
A    SCF.K=CLIP(FMOGC+FBOGC-.15,0,TIME.K,45)                        (217.2)
L    UP.K=UP.J+(DT)(NUPCR.JK-ER.JK+RUMR.JK)                         (218)
N    UP=UPN                                                         (218.1)
NOTE   UP-URBAN POPULATION (PERSONS)
C    UPN=1.8E6                                                      (218.2)
NOTE   UPN-URBAN POPULATION INITIAL (PERSONS)
L    RP.K=RP.J+(DT)(NRPCR.JK-RUMR.JK)                               (219)
N    RP=RPN                                                         (219.1)
NOTE   RPN-RURAL POPULATION INITIAL (PERSONS)
C    RPN=1.2E6                                                      (219.2)
NOTE   RP-RURAL POPULATION (PERSONS)
A    NP.K=UP.K+RP.K                                                 (220)
NOTE   NP-NATIONAL POPULATION (PERSONS)
A    WPCI.K=TABLE(WPCIT,TIME.K,0,100,10)                            (221)
T    WPCIT=1000/1200/1350/1450/1525/1575/1600/1620/1635/1645/1650
NOTE   WPCI-WORLD PER CAPITA INCOME (LL PER PERSON PER YR)
NOTE   WPCIN-WORLD PER CAPITA INC INITIAL (LL PER PERSON PER YR)
A    NPCI.K=GNP.K/NP.K                                              (222)
NOTE   NPCI-NATIONAL PER CAPITA INCOME (LL PER PERSON PER YR)
A    RNPCI.K=NPCI.K/WPCI.K                                          (223)
NOTE   RNPCI-RELATIVE NATIONAL PER CAPITA INCOME (DIM)
A    RNPCIR.K=RNPCI.K/RNPCIN                                        (224)
C    RNPCIN=4.8                                                     (224.1)
NOTE   RNPCIR-RELATIVE NATL PER CAPITA INCOME RATIO (DIM)
NOTE   RNPCIN-RELATIVE NATL PER CAPITA INCOME NORMAL (DIM)
A    RRI.K=TABLE(RRIT,PPARJ.K/PPNAJ.K,.1,2,.5)                      (225)
T    RRIT=0/.5/.8/1/1.1                                             (225.1)
NOTE   RRI-RELATIVE RURAL INCOME (DIM)
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A     PPARJ.K=TAP.K/TARJ.K                                              (226)
NOTE    PPARJ-PRODUCT PER AG-RELATED JOB (LL PER PERSON PER YR)
A     PPNAJ.K=NAGDP.K/NAJ.K                                             (227)
NOTE    PPNAJ-PRODUCT PER NON-AG JOB (LL PER PERSON PER YR)
A     RRIR.K=RRI.K/RRIN                                                 (228)
C     RRIN=.25                                                          (228.1)
NOTE    RRIR-RELATIVE RURAL INCOME RATIO (DIM)
NOTE    RRIN-RELATIVE RURAL INCOME NORMAL (DIM)
A     RUMM.K=TABLE(RUMMT,RRIR.K,0,6,1)                                  (229)
T     RUMMT=.05/0/-.03/-.04/-.05/-.06/-.07                              (229.1)
NOTE    RUMM-RURAL TO URBAN MIGRATION MULT (FRACT/YR)
A     RUMMR.K=DLINF3(RUMM.K,RLZT)                                       (230)
C     RLZT=3                                                            (230.1)
NOTE    RUMMR-RURAL TO URBAN MIGRATION MULT REALIZED (FRACT/YR)
NOTE    RLZT-REALIZATION TIME (YEARS)
A     MUPM.K=TABLE(MUPMT,UP.K/NP.K,0,1,.2)                              (231)
T     MUPMT=.02/.02/.015/0/-.03/-.045                                   (231.1)
NOTE    MUPM-MODERNIZATION OF URBAN POPULATION MULT (1/YR)
A     POLPM.K=TABLE(POLPMT,POLR.K,0,10,2)                               (232)
T     POLPMT=0/-.001/-.002/-.003/-.005/-.01                             (232.1)
NOTE    POLPM-POLLUTION POPULATION MULT (FRACT/YR)
A     POLPMR.K=DLINF3(POLPM.K,PED)                                      (233)
C     PED=5                                                             (233.1)
NOTE    PED-POLLUTION EFFECT DELAY (YEARS)
R     NUPCR.KL=UP.K*(UPCM.K+NUPCF)                                      (234)
C     NUPCF=.03                                                         (234.1)
NOTE    NUPCR-NATURAL URBAN POP CHANGE RATE (PERSONS/YR)
NOTE    NUPCF-NATURAL URBAN POP CHANGE FACTOR (FRACT/YR)
R     ER.KL=UP.K*(EM.K+EF)                                              (235)
C     EF=.0167                                                          (235.1)
NOTE    ER-EMIGRATION RATE (PERSONS/YR)
NOTE    EF-EMIGRATION FACTOR (FRACT/YR)
R     RUMR.KL=RP.K*(RUMMR.K+RUMF)                                       (236)
C     RUMF=.05                                                          (236.1)
NOTE    RUMR-RURAL TO URBANMIGRATION RATE(PERSONS/YR)
NOTE    RUMF-RURAL TO URBAN MIGRATION FACTOR (FRACT/YR)
R     NRPCR.KL=RP.K*(RPCM.K+NRPCF)                                      (237)
C     NRPCF=.033                                                        (237.1)
NOTE    NRPCR-NATURAL RURAL POP CHANGE RATE (PERSONS/YR)
NOTE    NRPCF-NATURAL RURAL POP CHANGE FACTOR (FRACT/YR)
A     EM.K=TABLE(EMT,RNPCIR.K,0,3,.5)                                   (238)
T     EMT=.1/.02/0/-.0167/-.03/-.03/-.03                                (238.1)
NOTE    EM-EMIGRATION MULTIPLIER (FRACT/YR)
A     MRPM.K=DLINF3(MUPM.K,MDT.K)                                       (239)
NOTE    MRPM-MODERNIZATION OF RURAL POPULATION MULT (1/YR)
A     MDT.K=MDTN*TABLE(REFRMT,(RPEF.K/RP.K)/(UPEFN/UPN),0,8,.8)         (240)
T     REFRMT=1.5/.5/.3/.2/.2/.2/.2/.2/.2/.2/.2                          (240.2)
C     MDTN=10                                                           (240.1)
NOTE    MDT-MODERNIZATION DISSEMINATION TIME (YEARS)
NOTE    REFRMT-RELATIVE EDUC FACIL RURAL MULT (DIM)
A     HRPM.K=TABLE(HRPMT,(RPHF.K/RP.K)/(RPHFN/RPN),0,16.2,1.8)          (241)
T     HRPMT=-.009/.0045/.005/.005/.005/.005/.005/.005/.005/.005         (241.1)
NOTE    HRPM-HEALTH RURAL POPULATION MULT (1/YR)
A     UPCM.K=MUPM.K+POLPMR.K                                            (242)
A     RPCM.K=MRPM.K+HRPM.K                                              (243)
A     GDP.K=NAGDP.K+TAP.K                                               (244)
NOTE    GDP-GROSS DOMESTIC PRODUCT (BIL LL PER YR)
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L    SWICY.K=SWICY.J+(DT)(SWIC.JK)                                    (245)
N    SWICY=SWICYN                                                     (245.1)
C    SWICYN=480E6                                                     (245.2)
NOTE   SWICY-SURFACE WATER IMPOUNDMENT CAPACTY (CU METERS)
A    IMC.K=SWICY.K*UIMC                                               (246)
C    UIMC=.02                                                         (246.1)
NOTE   IMC-IMPOUNDMENT MAINTENANCE COST (LL/YR)
NOTE   UIMC-UNIT IMPOUNDMENT MAINT COST (LL/M3-YR)
A    FBSW.K=CLIP(0,FBSWN,SWICY.K,MSWICY)                              (247)
C    FBSWN=.8                                                         (247.1)
C    MSWICY=1000E6                                                    (247.2)
NOTE   FBSW-FRACT BUDGET TO SURF WATER (DIM)
NOTE   MSWICY-MAX SURF WATER IMPDMT CAP (M3)
A    ICC.K=ICCN*SWICY.K/SWICYN                                        (248)
C    ICCN=1.0                                                         (248.1)
NOTE   ICC-IMPDMT CONSTRUCTION COSTS (LL/M3) (ICCN=WUCN*.4/SWICYN)
R    SWIC.KL=MAX(0,((WUCI.JK-WUCD.JK)*FBSW.K-IMC.K)/ICC.K)            (249)
NOTE   SWIC-SURF WATER IMPDMT CONSTRUCTION (M3/YR)
A    DER.K=(MC.K+BC.K+AC.K)/(MCN+BCN+ACN)                             (250)
NOTE   DER-DEMAND RATIO
A    DSWD.K=DER.K*AWDN*DDS                                            (251)
C    AWDN=825E6                                                       (251.1)
C    DDS=.67                                                          (251.2)
NOTE   DSWD-DRY SEASON WATER DEMAND (M3)
NOTE   AWDN-ANNUAL WATER DEMAND (M3/YR)
NOTE   DDS-DURATION DRY SEASON (YR)
A    DSWS.K=EAR*FFDS+MIN(SWICY.K,EAR*(1-FFDS))                        (252)
C    EAR=4800E6                                                       (252.1)
C    FFDS=.1                                                          (252.2)
NOTE   DSWS-DRY SEASON WATER SUPPLY (M3)
NOTE   EAR-EXPLOITABLE ANNUAL RAINFALL (M3)
NOTE   FFDS-FRACT FALLING IN DRY SEASON (DIM)
A    HED.K=SWICY.K*KHPMPY                                             (253)
C    KHPMPY=2.5                                                       (253.1)
NOTE   HED-HYDROELECTRIC OUTPUT (KWH/YR)
NOTE   KHPMPY-KWH PER CU METER PER YR (KWH/M3-YR)
A    TED.K=DER.K*EDN                                                  (254)
C    EDN=2000E6                                                       (254.1)
NOTE   TED-TOTAL ELECTRICITY DEMAND (KWH/YR)
NOTE   EDN-ELECTRICITY DEMAND NORMAL (KWH/YR)
NOTE   PHYSICAL INFRASTRUCTURE - HIGHWAYS
L    HLK.K=HLK.J+(DT)(HWYC.JK)                                        (255)
N    HLK=HLKN                                                         (255.1)
C    HLKN=1.8E4
NOTE   HLK-HWY LANE KILOMETERS (LANE-KM)
A    HLFO.K=HLK.K*LPK/LZH                                             (256)
C    LPK=.05                                                          (256.1)
C    LZH=1500                                                         (256.2)
NOTE   HLFO-HWY LAND FRACTION OCCUPIED (DIM)
NOTE   LPK-LAND PER KILOMETER (HA/KM-LAND)
NOTE   LZH-LAND ZONED HWYS (HA)
A    HCC.K=HCCN*HCCM.K                                                (257)
C    HCCN=212500                                                      (257.1)
NOTE   HCC-HWY CONSTRUCTION COST (LL/KM-LANE)
A    HCCM.K=TABLE(HCCMT,HLFO.K,0,1,.2)                                (258)
T    HCCMT=.9/.9/.9/1/8/25                                            (258.1)
NOTE   HCCM-HWY CONSTR COST MULT (DIM)
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P- 17 RUN-        MODEL NAME = NRDM - 1 (CASE 1)

A     UMC.K=UMCN*NCF.K/NCFN                                          (259)
NOTE    UMC-UNIT MAINTENANCE COST (LL/LANE-KM-YR)
C     NCFN=750                                                       (259.1)
C     UMCN=3333                                                      (259.2)
A     HMC.K=HLK.K*UMC.K                                              (260)
R     HWYC.KL=(FLTH*(LTFI.JK-LTFD.JK)+MV.K*HUR-HMC.K)/HCC.K          (261)
C     FLTH=.85                                                       (261.1)
C     HUR=800                                                        (261.2)
NOTE    HWYC-HWY CONSTRUCTION (LANE-KM/YR)
NOTE    FLTH-FRACT LAND TRANS IN HWYS (DIM)
NOTE    HUR-HIGHWAY USER REVENUES (LL/YR)
NOTE    HOUSING SECTOR
L     UID.K=UID.J+(DT)(UICR.JK-UIDR.JK-UIDRX.JK)                     (262)
N     UID=UIDN                                                       (262.1)
C     UIDN=1.0E6                                                     (262.2)
NOTE    UID-UPPER INCOME DWELLINGS (ROOMS)
L     LID.K=LID.J+(DT)(UIDR.JK+LICR.JK-LIDR.JK)                      (263)
N     LID=LIDN                                                       (263.1)
C     LIDN=1.0E6                                                     (263.2)
NOTE    LID-LOW INCOME DWELLINGS (ROOMS)
A     TDU.K=UID.K+LID.K                                              (264)
NOTE    TDU-TOTAL DWELLING UNITS (ROOMS)
A     RDPPM.K=TABLE(RDPPMT,DER.K*NPN/NP.K,0,8,1)                     (265)
T     RDPPMT=0/1/1.2/1.33/1.42/1.48/1.5/1.5/1.5                      (265.1)
C     NPN=3E6                                                        (265.2)
NOTE    RDPPM-ROOMS DESIRED PER PERSON MULT (DIM)
R     UIDRX.KL=(UID.K/LUID)*FUIDD                                    (266)
NOTE    UIDRX-UPPER INCOME DWELLING DEMOLITION RATE (ROOMS/YR)
C     RDPPN=.75                                                      (266.1)
NOTE    RDPP-ROOMS DESIRED PER PERSON MULT (DIM)
A     TDD.K=NP.K*RDPPN*RDPPM.K                                       (267)
S     DUD.K=TDD.K-TDU.K                                              (268)
NOTE    DUD-DWELLING UNIT DEFICIENCY (ROOMS)
NOTE    TDD-TOTAL DWELLING DEMAND (ROOMS)
A     DLFD.K=TDU.K*LPDU/LZD                                          (269)
C     LPDU=200                                                       (269.1)
C     LZD=10000E5                                                    (269.2)
NOTE    DLFD-DWELLING LAND FRACT OCCUPIED (DIM)
NOTE    LPDU-LAND PER DWELLING UNIT (SQ METERS/ROOM)
NOTE    LZD-LAND ZONED FOR DWELLINGS (M2)
A     DCCM.K=TABLE(DCCMT,DLFD.K,0.1,.2)                              (270)
T     DCCMT=.7/.8/1/2/4/7                                            (270.1)
NOTE    DCCM-DWELLING CONSTRUCTION COST MULT (DIM)
A     LICC.K=LICCN*DCCM.K                                            (271)
C     LICCN=20000                                                    (271.1)
NOTE    LICC-LOW INCOME (DWELLING) CONSTR COST (LL/ROOM)
NOTE    LICR-LOW INCOME CONSTR RATE (ROOMS/YR)
R     LICR.KL=(LIHP.K+RILIH.JK)/LICC.K                               (272)
R     LIDR.KL=LID.K/LLID                                             (273)
C     LLID=50                                                        (273.1)
NOTE    LIDR-LOW INCOME DWELLING DETERIORATION RATE (ROOMS/YR)
NOTE    LLID-LIFETIME LOW INCOME DWELLINGS (YR)
R     UIDR.KL=(UID.K/LUID)*(1-FUIDD)                                 (274)
C     LUID=30                                                        (274.1)
C     FUIDD=.2                                                       (274.2)
NOTE    UIDR-UPPER INCOME DWELLING DETERIORATION RATE (ROOMS/YR)
NOTE    LUID-LIFETIME UPPER INCOME DWELLINGS (YR)
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NOTE   FUIDD-FRACT UPPER INCOME D.U. DEMOLISHED (DIM)
R    UICR.KL=UID.K*UICN*UICM.K                                  (275)
NOTE   UICR-UPPER INCOME DWELLING CONSTR. RATE (ROOMS/YR)
A    UICM.K=TABLE(UICMT,DLFO.K,0,1,.2)                          (276)
T    UICMT=1/1/1/.8/.67/.6                                      (276.1)
NOTE   UICM-UPPER INCOME CONSTRUCTION MULT (DIM)
C    UICN=.03                                                   (276.2)
A    RENT.K=RENTN*DER.K                                         (277)
C    RENTN=500                                                  (277.1)
NOTE   RENT PER DWELLING (LL/YR-ROOM)
NOTE   TRADE-ENERGY SECTOR
A    TTLR.K=(ITF.K/ITFN)*TTLRN                                  (278)
C    TTLRN=1.0E9                                                (278.1)
NOTE   TTLR-TARIFF-TRANSIT-LOADING REVENUES (LL/YR)
A    MFD.K=MC.K*UMCFD*ETEM.K                                    (279)
C    UMCFD=.075E-3                                              (279.1)
NOTE   MFD-MANUF FUEL DEMAND (TON OIL EQUIVALENTS PER YR)
NOTE   UMCFD-UNIT MANUF CAPITAL FUEL DEMAND (TOE/YR-LL)
A    SFD.K=(BC.K+WUC.K+TCC.K+ITF.K+PEF.K+PHF.K)*USCFD*ETEM.K    (280)
C    USCFD=.025E-3                                              (280.1)
NOTE   SFD-SERVICE SECTOR FUEL DEMAND (TOE/YR)
NOTE   USCFD-UNIT SERVICE CAPITAL FUEL DEMAND (TOE/YR-LL)
A    AFD.K=AC.K*UACFD*ETEM.K                                    (281)
C    UACFD=.075E-3                                              (281.1)
NOTE   AFD-AGRICULTURE FUEL DEMAND (TOE/YR-LL)
NOTE   UACFD-UNIT AGRI CAPITAL FUEL DEMAND (TOE/YR-LL)
A    DFD.K=TDU.K*UDFD*ETEM.K                                    (282)
C    UDFD=.3                                                    (282.1)
NOTE   DFD-DOMESTIC FUEL DEMAND (TOE/YR)
NOTE   UDFD-UNIT DWELLING UNIT FUEL DEMAND (TOE/YR-ROOM)
A    TFD.K=MV.K*UVFD*ETEM.K                                     (283)
C    UVFD=2.5                                                   (283.1)
NOTE   TFD-TRANSPORTATION FUEL DEMAND (TOE/YR)
NOTE   UVFD-UNIT VEHICLE FUEL DEMAND (TOE/YR-VEH)
A    FIM.K=(MFD.K+SFD.K+AFD.K+DFD.K+TFD.K)*NCF.K+(EUO.K*FEUOF.K) (284)
NOTE   FIM-FUEL IMPORTS (LL/YR)
A    NCF.K=TABLE(NCFT,TIME.K,0,50,10)                           (285)
T    NCFT=750/1500/2000/2300/2450/2500                          (285.1)
NOTE   NCF-NATIONAL COST OF FUEL (LL/TOE)
R    MVGR.KL=MV.K*MVGN*VHCM.K                                   (286)
C    MVGN=.08                                                   (286.1)
NOTE   MVGR-MOTOR VEH GROWTH RATE (VEH/YR)
NOTE   MVGN-MOTOR VEH GROWTH NORMAL (1/YR)
L    MV.K=MV.J+(DT)(MVGR.JK)                                    (287)
N    MV=MVN                                                     (287.1)
C    MVN=300000                                                 (287.2)
NOTE   MV-MOTOR VEHICLES (VEH)
A    NMGE.K=NMGEN*(MO.K/NP.K)/MOPCN                             (288)
C    MOPCN=1667                                                 (288.1)
C    NMGEN=.25E9                                                (288.2)
NOTE   NMGE-NET MANUF GOODS EXPORTED (LL/YR)
NOTE   MOPCN-MANUF OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
A    NBSE.K=NBSEN*(BO.K/NP.K)/BOPCN                             (289)
C    BOPCN=4000                                                 (289.1)
C    NBSEN=.6E9                                                 (289.2)
NOTE   NBSE-NET BUSINESS SERVICES EXPORTED (LL/YR)
NOTE   BOPCN-BUSINESS OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
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P- 19 RUN-        MODEL NAME = NRDM - 1 (CASE 1)

A     NAPE.K=NAPEN*(AO.K/NP.K)/AOPCN                                    (290)
C     AOPCN=270                                                         (290.2)
C     NAPEN=.159                                                        (290.3)
NOTE    NAPE-NET AGRI PRODUCTS EXPORTED (LL/YR)
NOTE    AOPCN-AGRI OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
A     GNP.K=GDP.K+TTLR.K+NMGE.K+NDSE.K+NAPE.K-FIM.K                     (291)
NOTE    GNP-GROSS NATIONAL PRODUCT (LL/YR)
A     ETEM.K=TABLE(ETEMT,DER.K,0,10,2)                                  (292)
T     ETEMT=1.15/.85/.65/.5/.4/.35                                      (292.1)
NOTE    ETEM-ENERGY EFFICIENCY TECHNOLOGY MULTIPLIER (DIM)
A     GTP.K=MP.K*FMPGTP.K+BP.K*FBPGTP.K                                 (293)
NOTE    GTP-GOVT TRANSFER PAYMENTS (LL/YR)
S     GB.K=GP.K+GTP.K+TTLR.K*FTTLRB+FIM.K*FTAX                          (294)
C     FTTLRB=1.0                                                        (294.1)
C     FTAX=.2                                                           (294.2)
NOTE    GB-GOVT BUDGET (LL/YR-VEH)
NOTE    FTTLRG-FRACT TTL REVENUES TO BUDGET (DIM)
NOTE    FTAX-FUEL TAX (DIM)
S     PPP.K=NP.K/(JIPH.K*FWPHY.K)                                       (295)
A     FWPHY.K=TABLE(FWPHYT,JIPH.K,0,100000,10000)                       (295.1)
T     FWPHYT=1/.2/.16/.14/.13/.122/.115/.109/.104/.101/.10              (295.2)
NOTE    PPP-POP PER PHYSICIAN (DIM)
NOTE    FWPHY-FRACT WORKERS PHYSICIANS (DIM)
S     PCEC.K=TED.K/NP.K                                                 (296)
NOTE    PCEC-PER CAPITA ENERGY CONSUMPTION (TOE/YR-PERSON)
S     MVPC.K=MV.K/NP.K                                                  (297)
NOTE    MVPC-MOTOR VEHICLES PER CAPITA (VEH/PERSON)
A   FPWA.K=TABLE(FPWAT,ANPI.K,-2,4,1)                                   (298)
T   FPWAT=.42/.41/.4/.38/.35/.32/.3                                     (298.1)
NOTE    FPWA-FRACT POP OF WORKING AGE (DIM)
S     FEIF=JIF.K/(NAJ.K+TARJ.K)                                         (299)
NOTE    FWIF-FRACT WORKERS EMPLOYED IN FARMING (DIM)
S     ANRPP.K=(UID.K+LID.K)/NP.K                                        (300)
NOTE    ARMPP-AVER NO ROOMS PER PERSON (ROOMS/PERSON)
S     FALI.K=ICL.K/(ICL.K+NICL.K)                                       (301)
NOTE    FALI-FRACT AG LAND IRRIGATED (DIM)
S     ALT.K=ALTN+DLINF3(ALM.K,ALRT)                                     (302)
C     ALTN=.7                                                           (302.1)
C     ALRT=10                                                           (302.2)
NOTE    ALT-ADULT LITERACY (FRACT)
NOTE    ALRT-ADULT LITERACY REALIZATION TIME (YEARS)
A     ALM.K=TABLE(ALMT,UPEPCR.K+RPEPCR.K,0,24,2)                        (303)
T     ALMT=-.7/0/.12/.18/.21/.23/.245/.255/.262/.267/.27/.27/.27        (303.1)
A     UPEPCR.K=(UPEF.K/UP.K)/(UPEFN/UPN)                                (304)
NOTE    UPEPCR-URBAN PUBLIC ED PER CAPITA RATIO
A     RPEPCR.K=(RPEF.K/RP.K)/(RPEFN/RPN)                                (305)
NOTE    RPEPCR-RURAL PUBLIC ED PER CAPITA RATIO
A     VHCM.K=TABLE(VHCMT,(MV.K/HLK.K)/(MVN/HLKN),0,4,1)                 (306)
T     VHCMT=3/1/0/-.01/-.04                                             (306.1)
NOTE    VHCM-VEH HWY CONGESTION MULT (DIM)
S   POPU.K=(100)(UP.K/NP.K)                                             (307)
NOTE    POPU-PERCENTAGE OF POPULATION URBAN
A   ANPI.K=(100)(NUPCR.JK+NRPCR.JK)/NP.K                                (308)
NOTE    ANPI-ANNUAL NATURAL POPULATION INCREASE
S   PPWA.K=100*FPWA.K                                                   (309)
NOTE    PPWA-PERCENTAGE OF POPULATION OF WORKING AGE
S   POPDEN.K=NP.K/AREA                                                  (310)
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P- 20 RUN-        MODEL NAME = NRDM - 1 (CASE 1)

NOTE   POPDEN-POPULATION DENSITY (PERSONS / SQ KM)
C   AREA=10400                                                    (310.1)
S   TBPGNP.K=(GNP.K-GDP.K)/GNP.K                                  (311)
NOTE   TBPGNP-TRADE BALANCE PERCENTAGE OF GNP
A   PUNEM.K=TABLE(PUNEMT,(TLFO.K-JOBS.K)/TLFO.K,-.5,.5,.5)        (312)
T   PUNEMT=-20/0/30                                              (312.1)
NOTE   PUNEM-PERCENTAGE UNEMPLOYMENT
A   JOBS.K=TARJ.K+NAJ.K                                          (313)
A   TLFO.K=NP.K*FPWA.K                                           (314)
NOTE   TLFO-TOTAL LABOR FORCE
S   BPGNP.K=(100)(GB.K/GNP.K)                                    (315)
NOTE   BPGNP-BUDGET AS PERCENTAGE OF GNP
S   TPPGNP.K=(100)(GTP.K/GNP.K)                                  (316)
NOTE   TPPGNP-TRANSFER PAYMENTS AS PERCENTAGE OF GNP
S   PHSUB.K=FPHS.K*(100-PHPS.K)                                  (317)
NOTE   PHSUB-PERCENTAGE HEALTH SUBSIDIZED
A   PHPS.K=TABLE(PHPST,(PHF.K/NP.K)/(PHFN/NPN),0,.5,1)           (318)
T   PHPST=90/80/70/60/50/40                                      (318.1)
NOTE   PHPS-PERCENTAGE HEALTH IN PRIVATE SECTOR
S   PESUB.K=FPES.K*(100-PEPS.K)                                  (319)
NOTE   PESUB-PERCENTAGE EDUCATION SUBSIDIZED
A   PEPS.K=TABLE(PEPST,(PEF.K/NP.K)/(PEFN/NPN),0,.5,1)           (320)
T   PEPST=60/50/40/30/20/10                                      (320.1)
NOTE   PEPS-PERCENTAGE EDUCATION IN PRIVATE SECTOR
S   UPOPD.K=UP.K/UL.K                                            (321)
NOTE   UPOPD-URBAN POPULATION DENSITY (PERSONS/HECTARE)
S   AFSIZ.K=AL.K/JIF.K                                           (322)
NOTE   AFSIZ-AVER FARM SIZE (HECT / FARM)
S   FPCC.K=FPC.K*10000                                           (323)
NOTE   FPCC-FOOD PER CAPITA (KILOCALORIES / PERSON-DAY)
S   PALI.K=(ICL.K/AL.K)*100                                      (324)
NOTE   PALI-PERCENTAGE AGRI LAND IRRIGATED
S   TSPC.K=TSPCN*TSPCM.K                                         (325)
C   TSPCN=.05                                                    (325.1)
A   TSPCM.K=TABLE(TSPCMT,TCCR.K,0,.9,1)                         (325.2)
T   TSPCMT=0/2/3.8/5.5/7/8.3/9.5/10.5/11.2/12                    (325.3)
NOTE   TSPC-T.V. SETS PER CAPITA
S   CAPC.K=CAPCN*CAPCM.K                                         (326)
C   CAPCN=10                                                     (326.1)
A   CAPCM.K=TABLE(CAPCMT,TCCR.K,0,.9,1)                         (326.2)
T   CAPCMT=2/1.2/.8/.6/.5/.5/.5/.5/.5/.5                        (326.3)
NOTE   CAPC-CINEMA ATTENDANCE PER CAPITA (TRIPS/PERSON-YR)
S   HWYDEN.K=HLK.K/AREA                                          (328)
NOTE   HWYDEN-HIGHWAY DENSITY (LANE-KMS/SQ KM)
S   SWICPC.K=SWICY.K/NP.K                                       (329)
NOTE   SWICPC-SURF WATER IMPDMT CAPACITY PER CAPITA (M3/PER)
S   FIPGNP.K=(FIM.K/GNP.K)*100                                   (330)
NOTE   FIPGNP-FUEL IMPORTS AS PERCENT OF GNP
S   QOL.K=NPCI.K+(10000*RRI)-(2000*POLR.K)                      (331)
NOTE   QOL-QUALITY OF LIFE
NOTE   CONTROL
PRINT  PUNEM,NPCI,RRI
PRINT  QOL
PLOT MC=C,MO=O,MP=P
PLOT FEUCH=H/WDSR=W
PLOT NB=N,DB=D,RB=R,BE=E
PLOT GNP=N,GDP=C,FIM=F
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APPENDIX B
DEFINITIONS OF PARAMETERS

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*    NRDM-2
NOTE   AC-AGRICULTURAL CAPITAL (BIL LL)
NOTE   ACN-AGRICULTURAL CAPITAL INITIAL (BIL LL)
NOTE   ACILR-AG CAPITAL IRRI LAND RATIO (LL PER HECT)
NOTE   AO-AGRICULTURAL OUTPUT (BIL LL PER YR)
NOTE   AP-AGRICULTURAL PRODUCT (BIL LL PER YR)
NOTE   ACD-AG CAPITAL DEPRECIATION (BIL LL PER YR)
NOTE   ACI-AG CAPITAL INVESTMENT (BIL LL PER YR)
NOTE   AL-AGRICULTURAL LAND (HECTARES)
NOTE   ALN-AG LAND INITIAL (HECTARES)
NOTE   AJPACU-ADDITIONAL JOBS PER AG CAPITAL UNIT (PERSONS/LL E5)
NOTE   AWDN-ANNUAL WATER DEMAND (M3/YR)
NOTE   AFD-AGRICULTURE FUEL DEMAND (TOE/YR-LL)
NOTE   AOPCN-AGRI OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
NOTE   ARMPP-AVER NO ROOMS PER PERSON (ROOMS/PERSON)
NOTE   ALT-ADULT LITERACY (FRACT)
NOTE   ALRT-ADULT LITERACY REALIZATION TIME (YEARS)
NOTE   ANPI-ANNUAL NATURAL POPULATION INCREASE
NOTE   AFSIZ-AVER FARM SIZE (HECT / FARM)
NOTE   AFPI-AVER FRACT PRODUCT INVESTED (DIM)
NOTE   AFIP-AVER FRACT INVESTMENT IN PLANT (DIM)
NOTE   BOPCN-BUSINESS OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
NOTE   BPGNP-BUDGET AS PERCENTAGE OF GNP
NOTE   BC-BUSINESS CAPITAL
NOTE   BCN-BUSINESS CAPITAL INITIAL (BIL LL)
NOTE   BCR-BUSINESS CAPITAL RATIO(DIMENSIONLESS)
NOTE   BEUCR-BUSIN ELECT UTIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   BEDSM-BUSIN ELECT DEMAND SUPPLY MULT (DIMENSIONLESS)
NOTE   BWUCR-BUSIN WATER UTIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   BWDSM-BUSIN WATER DEMAND SUPPLY RATIO (DIMENSIONLESS)
NOTE   BTCCR-BUSIN TELE-COM CAPITAL RATIO (DIMENSIONLESS)
NOTE   BCDSM-BUSIN COMMUN DEMAND SUPPLY MULT (DIMENSIONLESS)
NOTE   BTFCR-BUSIN TRANS FACIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   BTDSM-BUSIN TRANS DEMAND SUPPLY MULT (DIMENSIONLESS)
NOTE   BCOR-BUSINESS CAPITAL OUTPUT RATIO (YEARS)
NOTE   BO-BUSINESS OUTPUT (BIL LL PER YR)
NOTE   BP-BUSINESS PRODUCT (BIL LL PER YR)
NOTE   BCD-BUSIN CAPITAL DEPRECIATION (BIL LL PER YR)
NOTE   BCI-BUSIN CAPITAL INVESTMENT (BIL LL PER YR)
NOTE   BE-BUSINESS ESTABLISHMENTS
NOTE   BLFO-BUSINESS LAND FRACTION OCCUPIED (DIMENSIONLESS)
NOTE   BECM-BUSIN ESTAB COST MULT (DIMENSIONLESS)
NOTE   BA-BUSINESS ADDITIONS (ESTAB PER YR)
NOTE   BR-BUSIN RESTORATIONS (ESTAB PER YR)
NOTE   BRP-BUSIN RESTORATIONS PROGRAMMED (ESTAB PER YR)
NOTE   CNILR-CAPITAL NON-IRRI LAND RATIO (LL PER HECT)
NOTE   CILR-CAPITAL IRRI LAND RATIO (LL PER HECT)
NOTE   CNILRN-CAPITAL NON-IRRI LAND RATIO INITIAL (LL PER HECT)
NOTE   CILRN-CAPITAL IRRI LAND RATIO INITIAL (LL PER HECT)
NOTE   CYMNIL-CAPL YIELD MULTIPLER NON-IRRI LAND (DIM)
NOTE   CYMIL-CAPL YIELD MULTIPLIER IRRIGATED LAND (DIM)
NOTE   CAPC-CINEMA ATTENDANCE PER CAPITA (TRIPS/PERSON-YR)
NOTE   CPME-COST PER MANUF ESTABLISHMENT (MIL LL PER ESTAB)
NOTE   CPMEN-COST PER MANUF ESTABLISHMENT NORMAL (MIL LL PER ESTAB)
NOTE   CPBE-COST PER BUSIN ESTAB (MIL LL PER ESTAB)
NOTE   CPBEN-COST PER BUSIN ESTAB NORMAL (MIL LL PER ESTAB)
NOTE   CSGDP-CONSTRUCTION SERVING G.D.P. (BIL LL PER YR)
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                    MODEL NAME = NRDM

NOTE   CP-CONSTRUCTION PRODUCT (BIL LL PER)
NOTE   CO-CONSTRUCTION OUTPUT (BIL LL PER YR)
NOTE   CC-CONSTRUCTION CAPITAL (BIL LL)
NOTE   CCOR-CONSTRUCTION CAPITAL OUTPUT RATIO (YEARS)
NOTE   DER-DEMAND RATIO
NOTE   DSWD-DRY SEASON WATER DEMAND (M3)
NOTE   DDS-DURATION DRY SEASON (YR)
NOTE   DSWS-DRY SEASON WATER SUPPLY (M3)
NOTE   DUD-DWELLING UNIT DEFICIENCY (ROOMS)
NOTE   DLFO-DWELLING LAND FRACT OCCUPIED (DIM)
NOTE   DFD-DOMESTIC FUEL DEMAND (TOE/YR)
NOTE   DM-DAMAGED MANUFACTURING (ESTABLISHMENTS)
NOTE   DMN-DAMAGED MANUFACTURING INITIALLY (ESTABLISHMENTS)
NOTE   DB-DAMAGED BUSINESS (ESTABLISHMENTS)
NOTE   DBN-DAMAGED BUSINESS INITIALLY (ESTABLISHMENTS)
NOTE   ER-EMIGRATION RATE (PERSONS/YR)
NOTE   EF-EMIGRATION FACTOR (FRACT/YR)
NOTE   EM-EMIGRATION MULTIPLIER (FRACT/YR)
NOTE   EAR-EXPLOITABLE ANNUAL RAINFALL (M3)
NOTE   EDN-ELECTRICITY DEMAND NORMAL (KWH/YR)
NOTE   ETEM-ENERGY EFFICIENCY TECHNOLOGY MULTIPLIER (DIM)
NOTE   EUC-ELECTRIC UTILITY CAPITAL (BIL LL)
NOTE   EUCN-ELECTRIC UTIL CAPITAL INITIAL (BIL LL)
NOTE   EUCR-ELECTRIC UTIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   EUO-ELECTRIC UTIL OUTPUT (BIL LL PER YR)
NOTE   EUP-ELECTRIC UTIL PRODUCT (BIL LL PER YR)
NOTE   EUCD-ELECT UTIL CAPITAL DEPRECIATION (BIL LL PER YR)
NOTE   EUCI-ELECT UTIL CAPITAL INVESTMENT (BIL LL PER YR)
NOTE   EWUIM-EFFICIENCY WATER UTIL INVESTMENT MULT (DIMEN)
NOTE   FGPPA-FRACT GOVT PROD TO PUBLIC ADMIN (DIM)
NOTE   FNICLR-FRACT NON-IRRI CULT LAND REMAINING (DIM)
NOTE   FP-FOOD PRODUCTION (THOUSAND VEG EQUIV TONS/HECT-YR)
NOTE   FGTPIN-FRACT GOVT TRANSFER PAYMENTS TO IRRI NORMAL (DIM)
NOTE   FLPPY-FRACT LAND PROGRAMMED PER YEAR (1/YR)
NOTE   FPC-FOOD PER CAPITA (THOUS VEG EQUIV TONS / YR-PERSON)
NOTE   FGTPIM-FRACT GOVT TRANSFER PAYMENTS TO IRRI MULT (DIM)
NOTE   FAOI-FRACT AG OUTPUT TO INPUTS (DIM)
NOTE   FAPI-FRACT AG PRODUCT INVESTED (DIM)
NOTE   FAOIR-FRACT AG OUTPUT TO IRRIGATION (DIM)
NOTE   FBSW-FRACT BUDGET TO SURF WATER (DIM)
NOTE   FFDS-FRACT FALLING IN DRY SEASON (DIM)
NOTE   FLTH-FRACT LAND TRANS IN HWYS (DIM)
NOTE   FUIOD-FRACT UPPER INCOME D.U. DEMOLISHED (DIM)
NOTE   FIM-FUEL IMPORTS (LL/YR)
NOTE   FTTLRG-FRACT TTL REVENUES TO BUDGET (DIM)
NOTE   FTAX-FUEL TAX (DIM)
NOTE   FWPHY-FRACT WORKERS PHYSICIANS (DIM)
NOTE   FPWA-FRACT POP OF WORKING AGE (DIM)
NOTE   FWIF-FRACT WORKERS EMPLOYED IN FARMING (DIM)
NOTE   FALI-FRACT AG LAND IRRIGATED (DIM)
NOTE   FPCC-FOOD PER CAPITA (KILOCALORIES / PERSON-DAY)
NOTE   FIPGNP-FUEL IMPORTS AS PERCENT OF GNP
NOTE   FMOG-FRACT MANUF OUTPUT TO GOVT (DIMENSIONLESS)
NOTE   FBOE-FRACT BUSIN OUTPUT TO ELECT (DIMENSIONLESS)
NOTE   FBOEN-FRACT BUSIN OUTPUT TO ELECT NORMAL (DIMENSIONLESS)
NOTE   FBOW-FRACT BUSIN OUTPUT TO WATER (DIMENSIONLESS)
NOTE   FBOWN-FRACT BUSIN OUTPUT TO WATER (DIMENSIONLESS)
```

MODEL NAME = NRDM

NOTE FBOC-FRACT BUSIN OUTPUT TO COMMUNICATIONS (DIMENSIONLESS)
NOTE FBOCN-FRACT BUSIN OUTPUT TO COMMUN NORMAL (DIMENSIONLESS)
NOTE FBOT-FRACT BUSIN OUTPUT TO TRANSPORTATION (DIMENSIONLESS)
NOTE FBOTN-FRACT BUSIN OUTPUT TO TRANS NORMAL (DIMENSIONLESS)
NOTE FBOIF-FRACT BUSIN OUTPUT TO INFRASTRUCTURE (DIMENSIONLESS)
NOTE FBOI-FRACT BUSIN OUTPUT TO INPUTS (DIMENSIONLESS)
NOTE FBPI-FRACT BUSIN PRODUCT INVESTED (DIMENSIONLESS)
NOTE FBOG-FRACT BUSIN OUTPUT TO GOVT (DIMENSIONLESS)
NOTE FEUCH-FRACT ELECT UTIL CAPL HYDROELECTRIC (DIMEN)
NOTE FEUOF-FRACT ELECT UTIL OUTPUT TO FUEL (DIMEN)
NOTE FEUPI-FRACT ELECT UTIL PRODUCT INVESTED (DIMEN)
NOTE FWUOI-FRACT WATER UTIL OUTPUT TO INPUTS (DIMEN)
NOTE FWUPI-FRACT WATER UTIL PRODUCT INVESTED (DIMEN)
NOTE FMOM-FRACT MANUF OUTPUT TO MATERIALS (DIMENSIONLESS)
NOTE FMOI-FRACT MANUF OUTPUT TO INPUTS (DIMENSIONLESS)
NOTE FMOIF-FRACT MANUF OUTPUT TO INFRASTRUCTURE (DIMENSIONLESS)
NOTE FMOTN-FRACT MANUF OUTPUT TO TRANS NORMAL (DIMENSIONLESS)
NOTE FMOT-FRACT MANUF OUTPUT TO TRANSPORTATION (DIMENSIONLESS)
NOTE FTCOI-FRACT TELE-COMMUN OUTPUT TO INPUTS (DIMEN)
NOTE FTCPI-FRACT TELECOMMUN PRODUCT INVESTED (DIMEN)
NOTE FIT-FRACT IN INTL TRANSPORT (DIMEN)
NOTE FITOI-FRACT INTL TRANSPORT OUTPUT TO INPUTS
NOTE FITPI-FRACT INTL TRANSPORT PRODUCT INVESTED
NOTE FLT-FRACT IN LAND TRANSPORT (DIMEN)
NOTE FLTOI-FRACT LAND TRANSPORT OUTPUT TO INPUTS (DIMEN)
NOTE FLTFI-FRACT LAND TRANSPORT FACIL INVESTED (DIMEN)
NOTE FMPGTP-FRACT. MANUF. PRODUCT GOVT. TRANSFER PAYMENT (DIM.)
NOTE FBPGTP-FRACT. BUSIN. PRODUCT GOVT. TRANSFER PAYMENT (DIM.)
NOTE FMOCN-FRACT MANUF OUTPUT TO COMMUN NORMAL (DIMENSIONLESS)
NOTE FMOC-FRACT MANUF OUTPUT TO COMMUNICATIONS (DIMENSIONLESS)
NOTE FMOWN-FRACT MANUF OUTPUT TO WATER NORMAL (DIMENSIONLESS)
NOTE FMOW-FRACT MANUF OUTPUT TO WATER (DIMENSIONLESS)
NOTE FMOEN-FRACT MANUF OUTPUT TO ELECT NORMAL (DIMENSIONLESS)
NOTE FMOE-FRACT MANUF OUTPUT TO ELECT (DIMENSIONLESS)
NOTE FEUPI-FRACT ELECT UTIL PROD INVESTED (DIM)
NOTE FCOI-FRACT CONSTRUCTION OUTPUT TO INPUTS (DIM)
NOTE FCPI-FRACT CONSTRUCTION PROD INVESTED (DIM)
NOTE FPES-FRACT PUBLIC EDUC SUBSIDIZED
NOTE FGPPE-FRACT GOVT PRODUCT TO PUBLIC EDUCATION (DIM)
NOTE FPEPI-FRACT PUBLIC EDUC PRODUCT INVESTED (DIM)
NOTE FIUPE-FRACT INVESTMENT URBAN PUBLIC EDUC (DIM)
NOTE FPHS-FRACT PUBLIC HEALTH SUBSIDIZED
NOTE FPHPI-FRACT PUBLIC HEALTH PRODUCT INVESTED (DIM)
NOTE FGPPH-FRACT GOVT PRODUCT TO PUBLIC HEALTH (DIM)
NOTE FIUPH.FRACT INVESTMENT URBAN PUBLIC
NOTE FRTI-FRACT RENT TO INPUTS
NOTE FOPLIH-FRACT GOVT PROD INVESTED IN LOW INCOME HOUSING (DIM)
NOTE GSCGDP-GOVT. SERVICE CONTRIB TO G.D.P. (BIL LL PER YR)
NOTE GBI-GOVT BUDGET TO IRRIGATION (BIL LL PER YR)
NOTE GDPWF-G.D.P. PER WORKER IN FARMING (LL/YR-PERSON)
NOTE GDPPWI-G.D.P. PER WORKER IN IRRIGATION (LL PER YR PER PERSON)
NOTE GDP-GROSS DOMESTIC PRODUCT (BIL LL PER YR)
NOTE GNP-GROSS NATIONAL PRODUCT (LL/YR)
NOTE GTP-GOVT TRANSFER PAYMENTS (LL/YR)
NOTE GB-GOVT BUDGET (LL/YR-VEH)
NOTE GDPPWM-G.D.P. PER WORKER IN MANUF (LL/YR-PERSON)
NOTE GDPPWB-G.D.P. PER WORKER IN BUSIN. (LL/YR-PERSON)

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NOTE   GDPWEU-G.D.P. PER WORKER IN ELECT UTIL (LL/YR-PERSON)
NOTE   GDPWWU-G.D.P. PER WORKER IN WATER UTIL (LL/YR-PERSON)
NOTE   GDPWTC-G.D.P. PER WORKER IN TELE-COM(LL/YR-PERSON)
NOTE   GDPWIT-G.D.P. PER WORKER IN INTL TRANS (LL/YR-PERSON)
NOTE   GDPWLT-G.D.P. PER WORKER IN LAND TRANS (LL/YR-PERSON)
NOTE   GDPPWC-G.D.P. PER WORKER IN CONSTR (LL/YR-PERSON)
NOTE   GP-GOVERNMENT PRODUCT (BIL LL PER YR)
NOTE   GDPWPU-G.D.P. PER WORKER PUBLIC EDUC (LL/YR-PERSON)
NOTE   GDPWPH-G.D.P. PER WORKER IN PUBLIC HEALTH (LL/YR-PERSON)
NOTE   HRPM-HEALTH RURAL POPULATION MULT (1/YR)
NOTE   HEO-HYDROELECTRIC OUTPUT (KWH/YR)
NOTE   HLK-HWY LANE KILOMETERS (LANE-KM)
NOTE   HLFO-HWY LAND FRACTION OCCUPIED (DIM)
NOTE   HCC-HWY CONSTRUCTION COST (LL/KM-LANE)
NOTE   HCCM-HWY CONSTR COST MULT (DIM)
NOTE   HWYC-HWY CONSTRUCTION (LANE-KM/YR)
NOTE   HUR-HIGHWAY USER REVENUES (LL/YR)
NOTE   HWYDEN-HIGHWAY DENSITY (LANE-KMS/SQ KM)
NOTE   IF-IRRIGATION FACILITIES (BIL LL)
NOTE   IFN-IRRIGATION FACILITIES INITIAL (BIL LL)
NOTE   ICL-IRRIGATED CULTIVATABLE LAND (HECTARES)
NOTE   ICLN-IRRIGATED CULTIVATABLE LAND INITIAL (HECTARES)
NOTE   IFLN-IRRI FACILITIES PER LAND INITIAL (LL PER HECT)
NOTE   ILYN-IRRIGATED LAND YIELD NORMAL (VEG EQUIV TONS/HECT-YR)
NOTE   ILDCM-IRRI LAND DEVELOPMENT COST MULT (DIM)
NOTE   ILDC-IRRI LAND DEVELOPMENT COSTS (LL PER HECT)
NOTE   ICCN-IRRI CONSTRUCTION COSTS INITIAL (LL PER HECT)
NOTE   ILDR-IRRI LAND DEVELOPMENT RATE (HECT PER YR)
NOTE   IFD-IRRI FACILITIES DEPRECIATION (BIL LL PER YR)
NOTE   IFI-IRRI FACILITIES INVESTMENT (BIL LL PER YR)
NOTE   IRP-IRRIGATION PRODUCT (BIL LL PER YR)
NOTE   IMC-IMPOUNDMENT MAINTENANCE COST (LL/YR)
NOTE   ICC-IMPDMT CONSTRUCTION COSTS (LL/M3) (ICCN=WUCN*.4/SWICYN)
NOTE   ITF-INTERNATIONAL TRANSPORT FACILITIES (BIL LL)
NOTE   ITFN-INTL TRANSPORT FACIL INITIAL (BIL LL)
NOTE   ITO-INTL TRANSPORT OUTPUT (BIL LL)
NOTE   ITP-INTL TRANSPORT PRODUCT (BIL LL PER YR)
NOTE   ITFD-INTL TRANSPORT FACIL DEPRECIATION (BIL LL PER YR)
NOTE   ITFI-INTERNATIONAL TRANS FACIL INVESTMENT (BIL LL PER YR)
NOTE   IFCGDP-INFRASTRUCTURE CONTRIB TO G.D.P. (BIL LL PER YR)
NOTE   JIPA-JOBS IN PUBLIC ADMINISTRATION (PERSONS)
NOTE   JPGPCU-JOBS PER GOVT PROD CAPITAL UNIT (PERSONS/LL E5)
NOTE   JIGS-JOBS IN GOVT SERVICES (PERSONS)
NOTE   JPH-JOBS PER HECTARE
NOTE   JIF-JOBS IN FARMING
NOTE   JPICU-JOBS PER IRRIGATION CAPITAL UNIT (PERSONS/LL E5)
NOTE   JII-JOBS IN IRRIGATION (PERSONS)
NOTE   JIAC-JOBS IN AG CAPITAL (PERSONS)
NOTE   JPMCU-JOBS PER MANUF. CAPITAL UNIT (PERSONS/LL E4)
NOTE   JIM-JOBS IN MANUFACTURING (PERSONS)
NOTE   JPBCU-JOBS PER BUSINESS CAPITAL UNIT (PERSONS/LL E4)
NOTE   JIB-JOBS IN BUSINESS (PERSONS)
NOTE   JPEUCU-JOBS PER ELECT UTIL CAPITAL UNIT (PERSONS/LL E5)
NOTE   JIEU-JOBS IN ELECTRIC UTILITIES (PERSONS)
NOTE   JPWUCU-JOBS PER WATER UTIL CAPITAL UNIT (PERSONS/LL E5)
NOTE   JIWU-JOBS IN WATER UTILITIES (PERSONS)
NOTE   JPTCCU-JOBS PER TELE-COM CAPITAL UNIT (PERSONS/LL E5)
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NOTE   JITC-JOBS IN TELE-COMMUNICATIONS (PERSONS)
NOTE   JPITCU-JOBS PER INTL TRANS CAPITAL UNIT (PERSONS/LL E5)
NOTE   JITF-JOBS IN INTL TRANS FACILITIES (PERSONS)
NOTE   JPLTCU-JOBS PER LAND TRANSPORT CAPITAL UNIT (PERSONS/LL E5)
NOTE   JLTF-JOBS IN LAND TRANS FACILITIES (PERSONS)
NOTE   JIC-JOBS IN CONSTRUCTION (PERSONS)
NOTE   JPCCU-JOBS PER CONSTRUCTION CAPITAL UNIT (PERSONS/LL E5)
NOTE   JPPECU-JOBS PER PUBLIC EDUC CAPITAL UNIT (PERSONS/LL E5)
NOTE   JIPE-JOBS IN PUBLIC EDUCATION (PERSONS)
NOTE   JPPHCU-JOBS PER PUBLIC HEALTH CAPITAL UNIT (PERSON/LL E5)
NOTE   JIPH-JOBS IN PUBLIC HEALTH (PERSONS)
NOTE   KHPMPY-KWH PER CU METER PER YR (KWH/M3-YR)
NOTE   LCCR-LAND CONVERSION COMPLETION RATE (HA/YR)
NOTE   LCR-LAND CONVERSION RATE (HA/YR)
NOTE   LCR-LAND CONVERSION RATE (HECT PER YR)
NOTE   LIF-LIFETIME IRRI FACILITIES (YEARS)
NOTE   LAC-LIFETIME AG CAPITAL (YEARS)
NOTE   LPK-LAND PER KILOMETER (HA/KM-LAND)
NOTE   LZH-LAND ZONED HWYS (HA)
NOTE   LID-LOW INCOME DWELLINGS (ROOMS)
NOTE   LPDU-LAND PER DWELLING UNIT (SQ METERS/ROOM)
NOTE   LZD-LAND ZONED FOR DWELLINGS (M2)
NOTE   LICC-LOW INCOME (DWELLING) CONSTR COST (LL/ROOM)
NOTE   LICR-LOW INCOME CONSTR RATE (ROOMS/YR)
NOTE   LIDR-LOW INCOME DWELLING DETERIORATION RATE (ROOMS/YR)
NOTE   LLID-LIFETIME LOW INCOME DWELLINGS (YR)
NOTE   LUID-LIFETIME UPPER INCOME DWELLINGS (YR)
NOTE   LMC-LIFETIME MANUF CAPITAL (YEARS)
NOTE   LPME-LAND PER MANUF ESTABLISHMENT (HECT PER ESTAB)
NOTE   LZM-LAND ZONED FOR MANUF (HECTARES)
NOTE   LBC-LIFETIME BUSINESS CAPITAL (YEARS)
NOTE   LPBE-LAND PER BUSINESS ESTABLISHMENT (HECT PER ESTAB)
NOTE   LZB-LAND ZONED PER BUSINESS (HECTARES)
NOTE   LEUC-LIFETIME ELECT UTIL CAPITAL (YEARS)
NOTE   LWUC-LIFETIME WATER UTIL CAPITAL (YEARS)
NOTE   LTCC-LIFETIME TELE-COMMUN CAPITAL (YEARS)
NOTE   LITF-LIFETIME INTL TRANSPORT FACIL (YEARS)
NOTE   LTF-LAND TRANSPORT FACILITIES (BIL LL)
NOTE   LTFN-LAND TRANSPORT FACIL INITIAL (BIL LL)
NOTE   LTO-LAND TRANSPORT OUTPUT (BIL LL PER YR)
NOTE   LTP-LAND TRANSPORT PRODUCT (BIL LL PER YR)
NOTE   LTFD-LAND TRANSPORT FACIL DEPRECIATION (BIL LL PER YR)
NOTE   LLTF-LIFETIME LAND TRANSPORT FACIL (YEARS)
NOTE   LTFI-LAND TRANSPORT FACIL INVESTMENT (BIL LL PER YR)
NOTE   LPEF-LIFETIME PUBLIC EDUC FACIL (YR)
NOTE   LPEF-LIFETIME PUBLIC EDUC FACIL (YEARS)
NOTE   LPHF-LIFETIME PUBLIC HEALTH FACILITIES (YR)
NOTE   LPHF-LIFETIME PUBLIC HEALTH FACIL (YEARS)
NOTE   LIHO-LOW INCOME HOUSING OUTPUT (BIL LL PER YR)
NOTE   LIHP-LOW INCOME HOUSING PRODUCT (BIL LL PER YR)
NOTE   MUPM-MODERNIZATION OF URBAN POPULATION MULT (1/YR)
NOTE   MRPM-MODERNIZATION OF RURAL POPULATION MULT (1/YR)
NOTE   MDT-MODERNIZATION DISSEMINATION TIME (YEARS)
NOTE   MSWICY-MAX SURF WATER IMPDMT CAP (M3)
NOTE   MFD-MANUF FUEL DEMAND (TON OIL EQUIVALENTS PER YR)
NOTE   MVGR-MOTOR VEH GROWTH RATE (VEH/YR)
NOTE   MVGN-MOTOR VEH GROWTH NORMAL (1/YR)
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NOTE   MV-MOTOR VEHICLES (VEH)
NOTE   MOPCN-MANUF OUTPUT PER CAPITA NORMAL (LL/YR-PERSON)
NOTE   MVPC-MOTOR VEHICLES PER CAPITA (VEH/PERSON)
NOTE   MCOR-MANUF CAPITAL OUTPUT RATIO (YEARS)
NOTE   MCORN-MANUF CAPITAL OUTPUT RATIO NORMAL (YEARS)
NOTE   MLAM-MANUF LAND AVAILABILITY MULT (DIM)
NOTE   MO-MANUF OUTPUT (BIL LL PER YR)
NOTE   MP-MANUF PRODUCT (BIL LL PER YR)
NOTE   MCD-MANUF CAPITAL DEPRECIATION (BIL LL PER YR)
NOTE   MCI-MANUF CAPITAL INVESTMENT (BIL LL PER YR)
NOTE   ME-MANUFACTURING ESTABLISHMENTS
NOTE   MLFO-MANUF LAND FRACT OCCUPIED (DIMENSIONLESS)
NOTE   MECM-MANUF ESTABLISHMENT COST MULT (DIMENSIONLESS)
NOTE   MA-MANUF ADDITIONS (ESTAB PER YR)
NOTE   MR-MANUF RESTORATIONS (ESTAB PER YR)
NOTE   MRP-MANUF RESTORATIONS PROGRAMMED (ESTAB PER YR)
NOTE   MTDSM-MANUF TRANS DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
NOTE   MTFCR-MANUF TRANS FACIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   MCDSM-MANUF COMMUN DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
NOTE   MTCCR-MANUF TELE-COM CAPITAL RATIO (DIMENSIONLESS)
NOTE   MWDSM-MANUF WATER DEMAND SUPPLY MULTIPLIER (DIMENSIONLESS)
NOTE   MWUCR-MANUF WATER UTIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   MEDSM-MANUF ELECT DEMAND SUPPLY MULTIPLIER(DIMENSIONLESS)
NOTE   MEUCR-MANUF ELECT UTIL CAPITAL RATIO (DIMENSIONLESS)
NOTE   MCR-MANUFACTURING CAPITAL RATIO(DIMENSIONLESS)
NOTE   MCN-MANUFACTURING CAPITAL INITIAL(BIL LL)
NOTE   MC-MANUFACTURING CAPITAL(BIL LL)
NOTE   NICL-NON-IRRIGATED CULTIVATABLE LAND (HECTARES)
NOTE   NICLN-NON-IRRI CULTIVATABLE LAND INITIAL (HECTARES)
NOTE   NILYN-NON IRRI LAND YIELD NORMAL (VEG EQUIV TONS/HECT-YR)
NOTE   NAGDP-NON AGRICULTURE G.D.P. (BIL LL PER YR)
NOTE   NP-NATIONAL POPULATION (PERSONS)
NOTE   NPCI-NATIONAL PER CAPITA INCOME (LL PER PERSON PER YR)
NOTE   NUPCR-NATURAL URBAN POP CHANGE RATE (PERSONS/YR)
NOTE   NUPCF-NATURAL URBAN POP CHANGE FACTOR (FRACT/YR)
NOTE   NRPCR-NATURAL RURAL POP CHANGE RATE (PERSONS/YR)
NOTE   NRPCF-NATURAL RURAL POP CHANGE FACTOR (FRACT/YR)
NOTE   NCF-NATIONAL COST OF FUEL (LL/TOE)
NOTE   NMGE-NET MANUF GOODS EXPORTED (LL/YR)
NOTE   NBSE-NET BUSINESS SERVICES EXPORTED (LL/YR)
NOTE   NAPE-NET AGRI PRODUCTS EXPORTED (LL/YR)
NOTE   NM-NORMAL MANUFACTURING (ESTABLISHMENTS)
NOTE   NMN-NORMAL MANUFACTURING INITIALLY (ESTABLISHMENTS)
NOTE   NB-NORMAL BUSINESS (ESTABLISHMENTS)
NOTE   NBN-NORMAL BUSINESS INITIALLY (ESTABLISHMENTS)
NOTE   NAJ-NON-AGRICULTURAL JOBS (PERSONS)
NOTE   PAP-PUBLIC ADMINISTRATION PRODUCT (BIL LL PER YR)
NOTE   POF-PRICE OF FOOD (LL PER TON)
NOTE   PPARJ-PRODUCT PER AG-RELATED JOB (LL PER PERSON PER YR)
NOTE   PPNAJ-PRODUCT PER NON-AG JOB (LL PER PERSON PER YR)
NOTE   POLPM-POLLUTION POPULATION MULT (FRACT/YR)
NOTE   PED-POLLUTION EFFECT DELAY (YEARS)
NOTE   PPP-POP PER PHYSICIAN (DIM)
NOTE   PCEC-PER CAPITA ENERGY CONSUMPTION (TOE/YR-PERSON)
NOTE   POPU-PERCENTAGE OF POPULATION URBAN
NOTE   PPWA-PERCENTAGE OF POPULATION OF WORKING AGE
NOTE   POPDEN-POPULATION DENSITY (PERSONS / SQ KM)
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NOTE   PUNEM-PERCENTAGE UNEMPLOYMENT
NOTE   PHSUB-PERCENTAGE HEALTH SUBSIDIZED
NOTE   PHPS-PERCENTAGE HEALTH IN PRIVATE SECTOR
NOTE   PESUB-PERCENTAGE EDUCATION SUBSIDIZED
NOTE   PEPS-PERCENTAGE EDUCATION IN PRIVATE SECTOR
NOTE    PALI-PERCENTAGE AGRI LAND IRRIGATED
NOTE   PCMM-POLLUTION CONTROL MANUF MULT (DIMENSIONLESS)
NOTE   POLR-POLLUTION RATIO (DIMENSIONLESS)
NOTE   PECOR-PUBLIC EDUC CAPITAL OUTPUT RATIO (YEARS)
NOTE   PEFN-PUBLIC EDUCATION FACIL INITIAL (BIL LL)
NOTE   PEO-PUBLIC EDUC OUTPUT (BIL LL PER YR)
NOTE   PEP-PUBLIC EDUCATION PRODUCT (BIL LL PER YR)
NOTE   PEF-PUBLIC EDUCATION FACILITIES (BIL LL)
NOTE   PHCOR-PUBLIC HEALTH CAPITAL OUTPUT RATIO (YEARS)
NOTE   PHFN-PUBLIC HEALTH FACIL INITIAL (BIL LL)
NOTE   PHO-PUBLIC HEALTH OUTPUT (BIL LL PER YR)
NOTE   PHP-PUBLIC HEALTH PRODUCT (BIL LL PER YR)
NOTE   PHF-PUBLIC HEALTH FACIL (LL)
NOTE   QOL-QUALITY OF LIFE
NOTE   RILIH-RECONSTRUCTION INVESTMENT IN LOW INCOME HOUSING (BIL LL PER
NOTE   RWIL-RELATIVE WIEGHT OF IRRI LAND (DIM)
NOTE   RCNILR-RELATIVE CAPL NON-IRRI LAND RATIO (DIM)
NOTE   RCILR-RELATIVE CAPITAL IRRI LAND RATIO (DIM)
NOTE   RACLR-RELATIVE AG CAPL LAND RATIO (DIM)
NOTE   RPN-RURAL POPULATION INITIAL (PERSONS)
NOTE   RP-RURAL POPULATION (PERSONS)
NOTE   RNPCI-RELATIVE NATIONAL PER CAPITA INCOME (DIM)
NOTE   RNPCIR-RELATIVE NATL PER CAPITA INCOME RATIO (DIM)
NOTE   RBN-RESTORED BUSINESS (ESTABLISHMENTS)
NOTE   RB-RESTORED BUSINESS (ESTABLISHMENTS)
NOTE   RNPCIN-RELATIVE NATL PER CAPITA INCOME NORMAL (DIM)
NOTE   RRI-RELATIVE RURAL INCOME (DIM)
NOTE   RRIR-RELATIVE RURAL INCOME RATIO (DIM)
NOTE   RRIN-RELATIVE RURAL INCOME NORMAL (DIM)
NOTE   RUMM-RURAL TO URBAN MIGRATION MULT (FRACT/YR)
NOTE   RUMMR-RURAL TO URBAN MIGRATION MULT REALIZED (FRACT/YR)
NOTE   RLZT-REALIZATION TIME (YEARS)
NOTE   RUMR-RURAL TO URBANMIGRATION RATE(PERSONS/YR)
NOTE   RUMF-RURAL TO URBAN MIGRATION FACTOR (FRACT/YR)
NOTE   REFRMT-RELATIVE EDUC FACIL RURAL MULT (DIM)
NOTE   RDPP-ROOMS DESIRED PER PERSON MULT (DIM)
NOTE   RENT PER DWELLING (LL/YR-ROOM)
NOTE   RPEPCR-RURAL PUBLIC ED PER CAPITA RATIO
NOTE   RPHF-RURAL PUBLIC HEALTH FACIL (LL)
NOTE   RIM-RECONSTRUCTION INVESTMENT IN MANUF (BIL LL PER YR)
NOTE   RM-RESTORED MANUF (ESTABLISHMENTS)
NOTE   RMN-RESTORED MANUF INITIALLY (ESTABLISHMENTS)
NOTE   RIB-RECONSTRUCTION INVESTMENT IN BUSINESS
NOTE   RITC-RECONSTRUCTION INVESTMENT IN TELECOMMUN (BIL LL PER YR)
NOTE   RIIT-RECONSTRUCTION INVESTMENT IN INTL TRANSPORT (BIL LL PER YR)
NOTE   RILT-RECONSTRUCTION INVESTMENT IN LAND TRANSPORT (BIL LL PER YR)
NOTE   RPEF-RURAL PUBLIC EDUC FACIL (LL)
NOTE   RPEFI-RURAL PUBLIC EDUC FACIL INVESTMENT (LL/YR)
NOTE   RPHFI-RURAL PUBLIC HEALTH FACIL INVESTED (LL/YR)
NOTE   RPHFD-RURAL PUBLIC HEALTH FACIL DEPRECIATION
NOTE   SWICY-SURFACE WATER IMPOUNDMENT CAPACTY (CU METERS)
NOTE   SWIC-SURF WATER IMPDMT CONSTRUCTION (M3/YR)
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