A DYNAMIC COMPUTABLE GENERAL EQUILIBRIUM MODEL FOR KUWAIT WITH ENDOGENOUS HUMAN CAPITAL

By

MUSAED A. BENEID

Bachelor of Arts
Kuwait University
Kuwait
1987

Advanced Diploma in General Development Planning
Arab Planning Institute
Kuwait
1990

Master of Arts
Vanderbilt University
Nashville, Tennessee
1994

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May, 2000

A DYNAMIC COMPUTABLE GENERAL

EQUILIBRIUM MODEL FOR KUWAIT

WITH ENDOGENOUS HUMAN

CAPITAL

Thesis Approved:

Michael J. Applegate

Adviser

Ronald J. Mann

James R. Jain

Daniel A. Tilley

Wayne B. Powell

Dean of the Graduate College

DEDICATION

To my mother and the spirit of my father

ACKNOWLEDGEMENTS

All praise is due to Allah, Lord of the Universe, without whose help and blessing this research would not have been accomplished.

I would like to express my sincere appreciation and gratitude to Professor Michael Applegate, my dissertation adviser, for his sustained source of guidance, encouragement, and patience. My sincere appreciation and gratitude is also extended to the other committee members: Professors Ronald Moomaw, James Fain, and Daniel Tilley for providing helpful suggestions and useful comments. I am grateful also to all my teachers, especially Professors Dan Rickman and Wade Brorsen for their help.

Acknowledgment is given to Dr. Ahmed Abo-Basha, Dr. Motaz Khorshid, and my friends Othman Al-Othman and Raja Alboqmi for their advice, useful discussions and for the data they provided.

I would like to thank Cindy Conway and Leslie Fife for their help in typing and editing this dissertation.

A special thanks to my mother for her prayers and encouragement and to my wife, Nafla, for her continuous support and patience and also to my daughter Asmaa and sons Abdulawahab and Abdulla for their patience. Finally, I am grateful to my brother, Yousef, and all my sisters for support and their help in collecting data for this study while I was in the United States.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The concept of human capital as an investment in education is not new in economics. Roughly two centuries ago, Adam Smith brought a paradigmatic shift through his famous *The Wealth of Nations,* wherein he posits that the creation of labor skills carries an expense which is paid off by a subsequent increase in productivity. However, that concept was regrettably forgotten until the publication of T. W. Schultz's "Investment in Human Capital" in 1961. In his article, Schultz regards the expenditure on education as *investment*, identifying several categories that can improve the quality of human effort and enhance the productivity of individuals. Direct expenditure on education, medical care, and on-the-job training are clear examples of these various categories (T. W. Schultz, 1961).

Human capital resources can be considered the ultimate base for the wealth of a nation. Unlike physical capital and natural resources, human capital is an active agent capable of generating and accumulating capital, and of committing natural resources to the economic, social, and political structures of the economy. (The rate of return to investment in human capital is discussed by Becker (1964) and Mincer (1974).) The differences between educated and uneducated laborers are seen not only in financial considerations, but also in their 'ability' that shapes the earning potential of resources.

Rosen (1976) shows the potential power of the structural approach to the theory of human capital. Recently, human capital became an important explanatory variable in both endogenous growth and augmented Solow models. It is found to have a direct impact on the productivity of labor (see Lucas (1988), Romer (1990), and Mankiew et al. (1992)).

Research is replete with a large number of studies regarding the application of human capital in the rapidly growing countries of East Asia and other areas. These studies show that the heavy initial investment in human capital, as well as physical capital, is largely responsible for the high per capita growth (see, among others, McMahon (1998) and Baffer and Shah (1998)).

The present research uses a dynamic computable general equilibrium model to examine the impact of migration, or *human capital flight*, on Kuwait's economy. The model is also used to demonstrate the impact of the investment in human capital--education--on the Kuwait economy as a special case. Finally, the study uses the CGE model to simulate the impact of a change in the retirement rate of indigenous labor on Kuwait economy.

Rationale

Since the present study concerns the Kuwait economy, an overview of the basic features of the Kuwait economy is necessary. Kuwait is a small, open economy, endowed with an exhaustible resource, oil. Human resources are vital to the country's sustained growth in the future. The government plays an active role in the economy since it is the sole owner of all oil resources and therefore the major employer for indigenous labor.

Although development came after the first shipment of oil exports in 1946, the 1970s were the most pleasant period for Kuwait because the price of oil underwent two significant upward shifts. These international changes in the oil market reflected into the domestic economy directly through government increases in revenues and indirectly through government expenditures and other public policies.

At this time, the government increased the funding it placed into the infrastructure of the welfare state aware of the role of both human and physical capital. The importance of enhancing human resources through better health and improving the quantity and quality of education, including vocational training, is stated clearly in the first Development Plan 1967/68 – 1971/72 (KUNA, p.35). Ambitious government programs were started by the government to achieve these goals. For example, the average annual growth rate of government expenditures on education during the 1970s was 15.6%, and the average annual growth rate of the numbers of government schools was about 10% for the same period. Through various kinds of education, the government reduced the percentage of illiterate in the total indigenous labor force from 90.6% in 1965 to 6.3% in 1995.[1] Also, for the same period, the percentage of the total indigenous labor force who hold a graduate or post-graduate degree increased from 1.2% to 19% (Ministry of Planning 1990 and PACI 1995).

However, these ambitious government programs led to a high influx of expatriate labor, which in turn created a high demographic imbalance between Kuwaitis and non-Kuwaitis. For example, the non-Kuwaiti population more than doubled during the period of the 1970s. This led Kuwaitis to become a minority in their own country, a result

disliked by Kuwaiti society and by policy makers for many reasons. For example, an imbalance might threaten the society of fewer than 2 million, risk the culture and values of the society, and put pressure on the public budget in the form of increased spending on the public services necessary to accommodate the increased population, especially with the high number of dependents the foreign workers have (Al-Awadi, p. 29).

Foreign workers in Kuwait do provide many economic advantages. On the supply side, they provide a ready human capital source, especially for those jobs that indigenous labor cannot fill. On the demand side, the foreign workers enhance the demand for goods and services provided by private sectors such as trade, housing, and many others. However, the economic costs of expatriate workers not only exist, but also are high. The effect of foreign labor remittances on the balance of payment is significant; it was 316 million KD ($1.06 billion) in 1995, an amount equivalent to 7.4 percent of total exports or about 4 percent of the GDP. By including the value of goods that foreign labor send to their home countries, that amount becomes much larger.

In a welfare state such as Kuwait, where public services are free or offered for less than cost, the economic cost of a large foreign population is significant. McLachlan (1985) estimates the cost of the foreign population in Kuwait to be 37.8 percent of the total public expenditure in the 1981/82 annual budget. In addition to the problem of increased spending on public services there is the lack of opportunities available to indigenous workers due to the number of jobs filled by cheaper expatriate labor. A further cost to Kuwait's economy is that a massive labor force decreases the use of

[1] In 1965, the indigenous labor force was defined as a Kuwaiti laborer aged 12 years and over, but in 1995 the minimum age became 15 years and over.

capital-intensive technology, which is more productive. Restricting the influx of expatriate labor would force indigenous labor to expand and increase the use of capital-intensive technology, which in turn escalates the productivity of the Kuwaiti workers.

The government looked to expatriate labor as a temporary situation until indigenous human capital could be built through education and training programs to replace the former. However, the participation rate of indigenous labor in the total labor force is still very low, standing at 17% in mid 1995. This might be attributed to three main characteristics of the Kuwaiti population and labor force: 1. Small population, 2. High percentage of young Kuwaitis in the total Kuwaiti population, 3. Low participation rates of Kuwaiti females in the Kuwaiti labor force.

Although there is an improvement in the quality of the indigenous labor force, the structure of expatriate labor must also be improved, or at least kept constant, in terms of the workers' skill levels for a positive impact on the economy to occur. Deterioration in the structure of expatriate labor can offset the effect of improvement in the quality of indigenous labor, which is what happened in the period between 1985 and 1995: the percentage of laborers in the total labor force holding graduate and post graduate degrees declined from 12.4% to 10.3%, even though that rate increased for the indigenous labor force from 12.8% to 19.7%. The overall decline in the percentage of the labor force with higher education can be attributed to the fact that the private sector usually looks for cheap labor.

Achieving high economic growth is one of the major concerns policy makers and Kuwait's economists. Since the main source of income in Kuwait is oil, which is exhaustible, and since the engine for development must come from the economy itself,

the government should not be highly dependent on that source of income for long-term growth. The question that is most relevant to Kuwait is how to achieve economic growth with less dependency on oil.

Recent economic-growth literature and endogenous-growth theories show a significant factor of production that was ignored for a long period of time, human capital. That factor can be accumulated and improved in many different ways, with education being the clearest source of such accumulation.

Policy makers in Kuwait should be more concerned about how to invest in human capital and also how to utilize it efficiently for long-term sustained economic growth.

The main questions that this study intends to answer are:

- What is the effect of a reduction of all and each skill of expatriate labor in the Kuwait economy?
- What is the economic impact of investing in different types of education in Kuwait?
- What is the impact of a change in social security laws regarding the retirement rate of Kuwaiti workers.

Hypotheses

The following hypotheses are tested in the present study:

H1: The reduction in the expatriate labor in Kuwait has a significant impact on the Kuwait economy in quantitative terms.

H2: Investment in education in Kuwait has a significant impact on the country's economic growth in Kuwait.

H3: A reduction in the retirement rate of indigenous labor has an important effect on Kuwait economy.

Objectives of the Present Study

The study has a threefold objective. First, the study is aimed at estimating quantitatively the role of all and each skill of expatriate labor by simulating a reduction in their participation in total labor force of Kuwait. Second, this study is aimed at determining the impact of investing in different types of education on the economic growth and the major economic variable of the Kuwait economy. And third, the study intends to simulate the impact of a reduction in the retirement rate of indigenous labor on the Kuwait economy.

Method of Study

Because of the complexity of the problem and the interactions among markets and the numerous economic variables, these three main objectives of the study can best be carried out by first building a dynamic multi-sector Computable General Equilibrium (CGE) for Kuwait, and then performing these simulations.

Unlike the static partial-equilibrium models, a dynamic, multi-sector Computable General Equilibrium (CGE) is chosen to be the method used in this study. The CGE model enables the examination of both direct and indirect effects of human capital on economic growth and other major economic variables. Although CGE models are an extension of input-output models, the former overcomes most of the latter's weaknesses, allowing for substitution and dealing with non-linearity as a relationship between variables.

In this study, the educational system will be incorporated to the CGE models to account for the endogenous labor supply. The labor requirements originated from two

main sources: the output of the educational system and the import of expatriate labor. For simplicity, the study assumes that the first source will provide the labor market with three types of labor: skilled, semi-skilled, and unskilled labor. The second source, expatriate labor, also consists of the same three types of workers. The study assumes that the expatriate workers are exogenous and the country can import as much labor as it needs at a current wage. In this framework, the government has some control over these two main sources of labor because it is the main provider of educational services and also it can influence the inflow of expatriate labor through migration policy. Moreover, the government can influence the decisions of the private sector regarding employment either directly or indirectly.

Framework

The dissertation is divided into six chapters; the next five chapters include Chapter II, which provides a broad description and analysis of population and the labor market. The structure of and policies for both indigenous and expatriate human capital is analyzed, and the role of the government in employment and the labor market discussed, especially regarding education. Chapter III presents a literature review of migration and the Computable General Equilibrium models. The model structure and calibration will be presented in Chapter IV, while Chapter V offers the simulation of a number of alternative policy experiments regarding migration, human capital and social issues. Finally, Chapter VI summarizes the main findings and presents the conclusions of the study.

Appendix A presents a list of the model equations, endogenous and exogenous variables, and model parameters. Appendix B gives the basic data of the model. The Gauss program that was used to solve the model is given in Appendix C.

CHAPTER II

INSTITUTIONAL ANALYSIS OF THE LABOR MARKET

Population Structure and Policy

The logical starting point of moving into the mainstream labor market is to closely observe the demographic changes in an economy. In Kuwait, the population policy has long been the nucleus for demographers and economy planners alike. The efforts of the Kuwaiti government to solve Kuwait's chronic problem of imbalance in the population structure are legion, and have been a major concern in economic and social plans in Kuwait since the late 1960s.

Many factors influence population growth and structure in Kuwait, such as economic, political, and demographic factors, which significantly affect the shaping of the population's structure and growth. The discovery of oil in 1946 and its role in the Kuwait economy is the most influential factor that drives the population growth to extremes, especially during the early stage of economic development when the demand for expatriate labor was very high.

Population by Nationality and Sex

The population of Kuwait was estimated to be 90,000 in 1946 (Khouja and Sadler, p. 37). According to the first census conducted in Kuwait in 1957, the total population

was 206,473. This means that the population more than doubled between 1946 and 1957. Kuwaitis accounted for 55 percent of the population in 1957, with Kuwaiti males accounting for 52.1 percent of that rate (see Table 1). Non-Kuwaitis scored 45 percent of the population, where females accounted for only 21.5 percent of that rate. This shows that the expatriate population structure is characterized by dominance of males who accounted for 78.5 percent of the total expatriate population in 1957.

Between 1957 and 1970, the average annual growth rate of the population[2] of Kuwait was 19.8 percent. This high growth rate can be attributed to immigration of workers to Kuwait, where the wage rates were higher as a result of higher demand for labor services to establish the infrastructure of the economy. The policy of mass naturalization of the Bedouin and of the people who live in Kuwait only for a period of time is the second reason for that high rate of population growth (Khouja and Sadler, p. 37). The political situation in the region also forced some Arab workers to migrate to Kuwait during that period, adding to the population total.

In 1970, at the end of this period, Kuwaitis numbered 347,396. This figure includes the "Bidoons" who are people who claim to be Kuwaitis, but not all of whom have a legitimate claim to Kuwaiti citizenship. (The government has already started the process of solving this problem, and it is expected to be totally resolved by 2002 (*Alwatan Newspaper*, 8-23-1999).) As a percentage of total population in 1970, the Kuwaitis account for 47 percent, where Kuwaiti females account for almost half of the total Kuwaitis. The percentage of non-Kuwaiti females in the total of non-Kuwaitis

[2] The average annual growth rate was calculated as follows. The difference between the recent number and the old number divided by the old number, all divided by the difference in the number of years, then all multiplied by 100.

increased to 37.5 percent, which can be attributed to improvements in the standard of living of expatriate workers, which in turn allowed them to bring their dependents. The social acceptance of female workers is also a relevant factor here.

Between the 1975 and 1985 censuses, the annual growth rate of the Kuwaiti population slowed down, but, at about 7.1 percent, it was still high. In 1985, the composition of the population of Kuwait by nationality was as follows: Kuwaitis (including Bidoons) accounted for 40.1 percent of the total population of 1,697,301. Arab non-Kuwaitis, primarily Palestinians and Jordanians, constituted 37.9 percent and Asians, mainly from India and Pakistan, composed 21 percent of the overall population.

The reduction of the share of Kuwaitis in the total population in the 1980s became a major concern for policy makers in Kuwait. This was sharpened by a decline in oil revenues in the mid 1980s, which increased the awareness of the social costs created by the non-Kuwaiti population (Russell and Al-Ramadhan, p. 572).

Achieving a demographic balance of 50-50 between Kuwaitis, including Bidoons, and non-Kuwaitis by the year 2000 was one of the major long term targets of the Five-Year Development Plan of 1985/86-1989/90, as was improving in the participation rate of the indigenous labor force (KUNA, p. 98).

The Plan focused on natural increases among Kuwaitis and linked naturalization to the skills of people. It suggested a reduction of the number of resident dependents who were members of foreign workers' families; it related the demand for labor to economic growth; and it asked for the demand for labor to be filled from the local labor market. The Plan also called for enhancing labor productivity, limiting low-skilled labor, and adopting intensive capital, rather than intensive labor, technology in terms of production.

The Plan began to see some success as the average annual growth rate of the population continued to slow down during 1980s to about 6 percent. This slow down has been affected largely by economic factors during that decade.

But the Plan did not have the success rate it hoped for. By 1989, the total population stood at 2,085,328. Kuwaitis (excluding Bidoons) numbered 565,736, which accounted for only 27.1 percent of the overall population, a rate, which is less than the 29.1 percent rate, which was the goal of the Plan. (It is worthwhile here to note that government statistics were revised by the end of the 1980s to exclude about 211,000 resident Bidoons who claim to be Kuwaitis until the investigation to resolve this problem. The recent preliminary investigation result shows that about half of this number hold citizenship in other countries.)

The percentage of Arab non-Kuwaitis in the total population reached 47.7 percent in 1989, which was due in part to including Bidoons in this category. The Asian share of the total population increased to reach 24.4 percent in the same year. What explains the higher share of Asians is the lower cost of their workers and their lower potential as security risks due to their tendency to stay only for short periods and to be disinterested in Kuwait's politics.

Table 1

Population of Kuwait by Nationality and Sex

Census Years		POPULATION			PERCENTAGE		
		Male	Female	Total	Male	Female	Total
1957	Kuwaiti	59,154	54,468	**113,622**	28.7	26.3	**55.0**
	Non-Kuwaiti	72,904	19,947	**92,851**	35.3	9.7	**45.0**
	Total	132,058	74,415	**206,473**	64.0	36.0	**100.0**
1961	Kuwaiti	84,461	77,448	**161,909**	26.3	24.0	**50.3**
	Non-Kuwaiti	116,246	43,466	**159,712**	36.1	13.6	**49.7**
	Total	200,707	120,914	**321,621**	62.4	37.6	**100.0**
1965	Kuwaiti	112,569	107,490	**220,059**	24.1	23.0	**47.1**
	Non-Kuwaiti	1,173,743	73,537	**247,280**	37.2	15.7	**52.9**
	Total	286,312	181,027	**467,339**	61.3	38.7	**100.0**
1970	Kuwaiti	175,513	171,883	**347,396**	23.7	23.3	**47.0**
	Non-Kuwaiti	244,368	146,898	**391,266**	33.1	19.9	**53.0**
	Total	419,881	318,781	**738,662**	56.8	43.2	**100.0**
1975	Kuwaiti	153,010	154,745	**307,755**	15.4	15.5	**30.0**
	Non-Kuwaiti	390,758	296,324	**687,082**	39.3	29.0	**69.1**
	Total	543,768	451,069	**994,837**	54.7	45.3	**100.0**
1980	Kuwaiti	191,492	195,203	**386,695**	20.7	21.0	**41.7**
	Non-Kuwaiti	585,147	386,110	**971,257**	36.5	21.8	**58.3**
	Total	776,639	581,313	**1,357,952**	57.2	42.8	**100.0**
1985	Kuwaiti	238,181	232,292	**470,473**	14.0	13.7	**27.7**
	Non-Kuwaiti	727,116	499,712	**1,226,828**	42.9	29.4	**72.3**
	Total	965,297	732,004	**1,697,301**	56.9	43.1	**100.0**
1989	Kuwaiti	279,778	285,958	**565,736**	13.4	13.7	**27.1**
	Non-Kuwaiti	909,549	610,043	**1,519,592**	43.6	29.3	**72.9**
	Total	1189,327	896,001	**2,085,328**	57.0	43.0	**100.0**
1995	Kuwaiti	351,314	356,801	**708,115**	17.9	18.2	**36.2**
	Non-Kuwaiti	841,320	409,359	**1,250,679**	43.0	20.9	**63.8**
	Total	1,192,634	766,160	**1,958,794**	60.9	39.1	**100.0**

Sources: *Annual Statistical Abstract*, different issues, Ministry of Planning (for 1985 data and earlier).
Population and Labor Force, PACI, Dec. 1989, and Jan. 1996 (for 1989 and 1995 data).
Note: "Bidoons" are included as Kuwaitis in data of 1970 and earlier.

In 1990, the Ministry of Planning prepared the Long-Term Plan, which targeted 40 percent as a realistic share of Kuwaitis in the total population. The Five-Year Plan 1990/91-1994/95 was also ready to achieve the goals of the former plan. However, the Iraqi invasion of Kuwait not only interrupted this Plan's implementation, but it also created totally different economic, political, and social situations. The Iraqi invasion and

the Kuwait liberation war led most of the non-Kuwaiti population to leave the country, which created an opportunity for the government to control many variables that could not be efficiently influenced by policies. Since the liberation of Kuwait in 1991, the population policy has become more important and vital to the highest levels of the government due to the unusual opportunity the war created for Kuwait to alter the population imbalance. Also, it was one of the main issues in the Amir's annual speech in 1992 (Russell and Al-Ramadhan, 1994). Many official committees have been established to form the new population policies and to organize the labor market.

The National Council (which has no legislative power) called for 70 percent of Kuwaitis in the total population, restricting the demand for expatriate workers for high-skilled labor, and also limiting the residency of non-Kuwaitis to five years. The Council encouraged marriages between Kuwaitis and asked for solutions to the problem of Bidoon citizenship. However, meeting some of these objectives is unrealistic due to the percentages the council hopes to achieve.

In 1992, the government adopted the resolution of the Supreme Planning council, which is based on the recommendation of the Academic Team for Population Policy (ATPP). The resolution brought a new population policy that can be summarized as follows (Russell and Al-Ramadhan):

1. The preservation of Kuwaiti's Muslim and Arab identity, which indicate a priority need for laborers in this category.
2. A strong emphasis on security, which means a Kuwaiti control of strategic establishments and also diversification of sources of migrant labor.

3. A restriction on the migration rate of growth in order to achieve a 60 percent share of Kuwaitis in the total population by 1995, and to increase the share in the total labor force.

To achieve this 60 percent target rate, the government adopted the recommendations of the ATPP and rejected the policy of mass naturalization. The policy called for giving preference to highly skilled and educated labor migrants, reducing the dependency in the migrant population, and gradually transferring the social costs of migrants from the government to employers, even though the policy argued for allowing labor market forces to shape labor demand.

However, the provisional data from the April 1995 census indicate that the Kuwaiti total population was only 41.6 percent, which is far from the target rate. By the end of 1995, Kuwaitis numbered 708,115 and their share in the total population was only 36.2 percent, according to Public Authority of Civil Information (PACI). Kuwaiti males accounted for 17.9 percent of total population, whereas the females constituted 18.2 percent. Shares of non-Kuwaiti males and females in the total population were 43 and 20.9 percents, respectively, which indicates how skewed the structure of population is toward non-Kuwaitis.

According to PACI statistics, the share of Arab non-Kuwaitis of the total population, for the period between 1989 to 1995, fell below the share of Asian non-Kuwaitis, which countermanded the ATPP's recommendation regarding the preservation of an Arab identify. The former dropped to 31.1 percent, whereas the latter jumped to 31.8 percent (about 50 percent of non-Kuwaitis). Most of the reduction in the Arab population comes from the departure of many Palestinians and Jordanians after the

liberation of Kuwait. Although this broad change in the structure of the population does not fulfill the announced population policy of the Kuwaiti government, it does clearly reflect the security concerns of the government.

These security concerns became part of the Five-Year Development Plan 1995/96-1999/2000, which was concerned with the population's composition and the development of the indigenous labor force, as well as with the budget deficit that deepened sharply in the early 1990s due to of the Gulf War. The Plan called for the following:

1. To preserve the natural rate of increase of Kuwaitis, which is about 3.5 percent.
2. To reject naturalization as a policy to increase Kuwaitis and to reduce unskilled labor in both public and private sectors.
3. To design criteria for the selection of expatriate labor and to match the supply of expatriate labor of different nationalities with the real demand in a way that goes along with Kuwait's society and security.
4. To suggest a minimum limit for the percentage of indigenous labor in private establishments.

This Plan tries to transfer the cost of foreign workers in the form of health and other social services from the government to the employers, which can help the public budget and which supports hiring indigenous labor in the private sector. It also can reduce extravagancy in the consumption of public goods and services.

According to the expectations of this plan, the total population will be 2,221,200 in 1999, and Kuwaitis will account for 36.5 percent of the total population. This low rate indicates the current lack of success the migration policy is having in implementing its

population goals, even though the policy plays a major part in all of the previous economic development plans.

Population by Age

The distribution of the Kuwaiti population by age group gives a good indication of the active population in the labor force. The Kuwaiti population is described as young due to the large number aged between 0 and 14 years, a number which occurs due to the fact that Kuwaiti females have a high fertility rate, that health care has seen significant improvement, and that the government now offers support for each child, which helps decrease mortality rates and encourages families to enlarge. In 1970, more than half of the Kuwaiti population was classified in the age group 0 to 14 years. The high percentage rate of the very young in the Kuwaiti population is one of the reasons why Kuwaitis have a low participation rate in the labor force. The young population, in part, leads to a high demand for expatriate labor to participate in economic activities; however, that will not remain true as these young people grow up and become active participants in the economy.

Table 2 shows the distribution of the population by nationality and age group in terms of percentages of the population. The share of Kuwaitis of the 0-14 age group in the population was reduced to 45.2 percent, then to 44.3 percent for 1989 and 1995, respectively. The education of Kuwaiti girls and their entrance into the labor force are the main factors for this reduction. At the same time, the age group of 0 to 14 for the non-Kuwaiti population was decreasing continuously, from 43.2 percent in 1970, to 33.8 percent in 1980, and then to 29.5 and 17.1 percents for 1989, and 1995, respectively. The

dependency rate of non-Kuwaitis in that group was supposed to reduce their demand on the free, or subsidized, public services that the government provides, which in turn lowers the cost of expatriate population or workers; overall, this decline indicates that the population policy has achieved a limited success in this regard.

Since the definition of the labor force required the age range to be between 15 and 65, we also need to know the percentage of the population that falls into the age group of 65 and over, as this group is expected to be economically inactive. The data provided by PACI indicate that the Kuwaiti population that fall into this age group was 2.1 percent of

Table 2

Population by Nationality and Age Group

Year	Age Group	Population			Percentage		
		K	NK	Total	K	NK	Total
1970	0-14	174,063	145,238	319,301	50.1	37.1	43.2
	15 and over	173,333	246,028	419,361	49.9	62.9	56.8
	Total	347,396	391,266	738,662	100.0	100.0	100.0
1980	0-14	278,288	267,435	545,723	42.4	38.8	40.2
	15 and over	378,325	524,904	812,229	57.6	66.2	59.8
	Total	656,613	792,339	1,357,952	100.0	100.0	100.0
1989	0-14	255,779	448,946	704,725	45.2	29.5	33.8
	15 and over	309,957	1,070,646	1,380,603	54.8	70.5	66.2
	Total	565,736	1,195,592	2,085,328	100.0	100.0	100.0
1995	0-14	313,878	214,098	527,976	44.3	17.1	27.0
	15 and over	394,237	1,036,581	1,430,818	55.7	82.9	73.0
	Total	708,115	1,250,679	1,958,794	100.0	100.0	100.0

Sources: *Statistical abstract in 25 Years*, Ministry of Planning, 1990.
Population & Labor Force, PACI, Dec. 1989 and Jan. 1996.
Note: Other educational levels are not included.

the Kuwaiti population in 1989, and that it increased to reach 2.4 percent in 1995. However, that rate for non-Kuwaitis fell from 0.9 percent in 1989 to only 0.6 percent of the non-Kuwaiti population, which also indicates a success for the population policy in reducing the dependency rate of expatriate labor in that age group.

Population by Educational Level

The improvement of the educational level in the Kuwaiti population is significant, especially for Kuwaiti females. Table 3 shows that about half, 48.3 percent, of the Kuwaiti population was illiterate in 1970, but that this rate has declined over time until it reached only 10 percent in 1995.

Table 3

Percent of Population (10 Years and Over) by Educational Status

Year	Educational Levels	K			NK			Total		
		M	F	Total	M	F	Total	M	F	Total
1970	Illiterate	33.1	63.8	48.3	32.8	35.6	33.7	32.9	56.1	40.2
	Secondary & Below University	4.5	2.1	3.3	10.0	12.9	11.0	8.0	7.7	7.6
	University & Post-Grad	1.0	0.3	0.6	5.4	3.4	4.8	3.7	1.8	2.9
1980	Illiterate	22.7	49.6	36.4	24.9	22.9	24.2	24.3	35.7	28.9
	Secondary & Below University	10.2	7.7	8.9	13.5	17.0	14.7	12.5	12.5	12.5
	University & Post-Grad	3.1	1.8	2.4	9.6	7.2	8.8	7.6	4.6	6.4
1989	Illiterate	6.9	20.3	13.8	15.9	18.1	16.8	14.1	18.8	16.0
	Secondary & Below University	19.6	16.8	18.1	16.9	18.7	17.6	17.4	18.1	17.7
	University & Post-Grad	8.1	6.5	7.3	8.5	6.9	7.9	8.4	12.1	7.7
1995	Illiterate	4.5	15.3	10.0	13.1	14.4	13.5	11.1	14.8	12.5
	Secondary & Below University	20.2	19.5	19.8	17.0	17.3	17.1	17.8	18.2	17.9
	University & Post-Grad	7.5	7.8	7.7	7.6	6.9	7.4	7.6	7.3	7.5

Sources: *Statistical Abstract in 25 Years*, Ministry of Planning, 1990.
Population and Labor Force, PACI, Dec. 1989 and Jan. 1996.

The percentage of Kuwaitis who held graduate and post-graduate degrees also improved over time, increasing from only 0.6 percent to 7.7 percent between 1970 and 1995, respectively. This can be contributed to the ambitious educational programs the government started in the late 1960s. On the other hand, the non-Kuwaiti population has also experienced improvement in education, but it is moderately relative to the improvement of the Kuwaiti population. By comparing the educational level of the non-

Kuwaiti population before the Iraqi invasion and after, we notice a decrease in both the percentage of the illiterate population and the percentage of highly educated people.

Total Labor Force

As mentioned in the previous section, the economic factor in Kuwait has influenced the rate of population and labor force growth significantly. Building physical capital and the infrastructure of the economy induced a high demand for labor. Because the supply of indigenous labor was both too small to satisfy the demand and short of skills, the economy was forced to accept a high percentage of expatriate workers in the total labor force as the only option to implementing the economic development plan's goals.

Table (4) shows the total labor force and the inactive category by nationality and sex for the period 1965 to 1995.

Table 4

Total and Inactive Labor Force

Year	Description	Kuwaiti			Non-Kuwaiti			Total		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
1965	Total Labor Force	41,926	1,092	43,018	133,603	7676	141,279	175,529	8,768	184,297
	% of Population	37.2	1.0	19.5	76.9	10.4	57.1	61.3	4.8	39.4
	Inactive	22,790	60,675	83,465	7,868	35,499	43,367	30,658	96,174	126,832
	% of Population (15+)	35.2	98.2	66.0	5.6	82.2	23.4	14.8	91.6	40.7
1970	Total Labor Force	63,314	2,055	65,369	162,286	14,541	176,827	225,600	16,596	242,196
	% of Population	36.1	1.2	18.8	66.4	9.9	45.2	53.7	5.2	32.8
	Inactive	37,338	96,852	134,190	15,103	68,844	83,947	52,441	165,696	218,137
	% of Population (15+)	37.1	98.0	67.2	8.5	82.6	32.2	18.8	90.9	47.4
1975	Total Labor Force	84,367	7,477	91,844	185,009	27,729	212,738	269,376	35,206	304,582
	% of Population	35.7	3.2	19.5	60.2	12.9	40.7	50.4	7.8	30.6
	Inactive	34,162	112,640	146,802	16,116	86,430	102,546	50,278	199,070	24,348
	% of Population (15+)	28.8	93.8	61.5	8.0	75.7	32.5	15.7	85.0	45.0
1980	Total Labor Force	60,921	13,157	74,078	367,311	50,120	417,431	428,232	63,277	491,509
	% of Population	31.8	6.7	19.2	62.8	13.0	43.0	55.1	10.9	36.2
	Inactive	37,202	89,249	126,451	33,832	160,437	194,269	71,034	249,686	320,720
	% of Population (15+)	37.9	87.2	63.1	8.4	76.2	31.8	14.2	79.8	39.5
1985	Total Labor Force	71,167	24,645	95,812	467,090	107,483	574,573	538,257	132,128	670,385
	% of Population	29.9	10.6	20.4	64.2	21.5	46.8	55.5	18.1	39.5
	Inactive	55,489	98,451	153,940	53,339	194,552	247,891	108828	293003	401831
	% of Population (15+)	43.8	80.0	61.6	10.2	64.4	30.1	16.8	68.9	375.
1989	Total Labor Force	88,778	37,764	126,542	609,530	173,591	783,121	698,308	211,355	909,663
	% of Population	30.7	13.2	22.4	67.0	28.5	51.5	58.7	23.6	43.6
	Inactive	58,726	121,424	180,150	63,600	216,209	279,809	122,326	337,633	459,959
	% of Population (15+)	40.0	76.3	58.1	9.3	55.5	26.1	14.7	61.5	33.3
1995	Total Labor Force	118,608	56,332	174,940	692,092	184,494	876,586	810,700	240,826	1,051,526
	% of Population	33.8	15.8	24.7	82.3	45.1	70.1	68.0	31.4	53.7
	Inactive	70,971	145,690	216,661	37,046	120,798	157,844	108017	266488	374505
	% of Population (15+)	36.9	72.1	55.0	5.1	39.6	15.2	11.7	52.5	26.2

Sources: - *Statistical Abstract in 25 Years*, Ministry of Planning, 1990.
- *Population and Labor Force*, PACI, Dec. 1989 and Jan. 1996.

Note: - For 1965 and 1970, the labor force age is 12 and over; otherwise, it is 15 and over.
- Government census statistics of 1980 and later were revised by treating more than 30 thousand persons "Bidoon" as non-Kuwaitis until investigation proved them to be Kuwaitis.

Labor Force by Nationality and Sex

In 1970, the total labor force was 242,196; 73 percent was expatriate labor. During the 1970s, the average annual growth rate of Kuwait's labor force was 10.3 percent. Most of that growth came from expatriate labor whose share had increased by1980 to 84.9 percent. That high growth rate continued through the 1980s, but was less intense (9.5 percent). However, in the mid-1980s, the reduction of the price of oil was the main factor that slowed down the economic activities, thus, decreasing the demand for labor. Although the expatriate labor rate for the period of 1985-1988 dropped to

about 3 percent, Asian workers increased rapidly during this time, comprising about 30 percent of the total labor force in 1980, then reaching 47 percent in 1989. The higher demand for Asian labor, relative to non-Kuwaiti Arab workers, can be attributed to the former's lower number of dependents and the shorter period they stay in Kuwait, in addition to other economic factors, such as a lower wage rate.

By 1989, the total labor force numbered 909,663; the share of indigenous labor was only about 14 percent. After the Iraqi invasion, most of the non-Kuwaiti population fled from Kuwait; after Kuwait's liberation, this decreased immigrant population left the country with a sharp shortage of labor, creating a negative growth rate for the labor force for a period in 1990. In the early years of the 1990s, the growth rate rapidly increased until it reached 2.6 percent for the period from 1989 through 1995.

In 1995, the total labor force exceeded one million (1,051,526) and the share of Kuwaitis increased to 16.6 percent, or 174,940. The ratio of the Kuwaiti labor force to its overall population was growing slowly over time until it reached 24.7 percent; however, that rate for non-Kuwaitis was growing more rapidly reaching 70.1 percent by 1995.

The low participation rate of Kuwaitis in the total labor force can be attributed to the following factors:

1. The high percent of young in the Kuwaiti population; 44.3 percent of the Kuwaiti population fell into the age group 0-14 in 1995.
2. The high percentage of Kuwaitis 15 years and older who are still students. This means that the actual working age is not actually represented by the definition of labor force where the age is above 15, especially when we know that students are not allowed by law to be both students and to hold jobs in the public sector.

3. Kuwaiti females, half of the Kuwaiti population, have low tendency to participate in the labor force due to social and cultural reasons. Even though there has been so much social change toward the idea of women working since the 1970s, Kuwaiti females usually limit their participation to jobs that are socially acceptable for females, such as teaching, nursing, and social work. Despite these limits, the average annual growth rate of the Kuwaiti female labor force was 54 percent during the 1970s and 20.8 percent during the 1980s; these high rates of growth reflect an equivalent social change regarding the employment of Kuwaiti females.
4. The high percentage of retirees from the indigenous labor force, despite its overall characterization as young labor force. The rules of the social security system can be largely blamed for such a loss of human capital. For example, a Kuwaiti male worker aged less than 50 can retire after 20 years of service (15 years for those who reach 50 years of age) and receive 75 percent of his salary at retirement. Married female workers can retire after 15 years of service. Moreover, the retired person is eligible for a loan from his retirement benefit; the amount of the loan is in direct proportion to age; the amount lessens as the applicant ages, until the amount is zero at age 65. (PISS, vol. 1, pp. 1-87.) The impact of this fourth factor on the Kuwaiti labor force is significant.

In the financial year 1987/1988, 63.5 percent of Kuwaiti males retired before they reach 50 years of age, and 82 percent of Kuwaiti females retired before they reached 45 years of age (Al-Quisi, pp. 328-329). The result of these rules is not only a reduction in the participation rate of Kuwaitis in the labor force, but also that the reduction comes from senior employees who have the most experience, thus leading to a destruction of

Kuwaiti human capital accumulation. Because on-the-job training is a major factor for building human capital, along with education, and because job experience is a key factor in increasing productivity, this retirement system undermines Kuwait's labor force.

Lately, the policy makers realized that this deficiency in the social security system has serious consequences; thus, starting from May 1993, they have introduced some changes. Most importantly, the minimum retirement age was raised to 45 in 1996, and will continue to be raised gradually to 55 by 2020. Also, the minimum 15 years of service for female is restricted to those who have children (PISS, pp. 1-87). These changes are expected to support the Kuwaiti labor participation rate and allow for more efficient use of human resources, which in turn leads to achieving the announced goals of the development plans with respect to indigenous human capital.

The inactive category of Kuwaiti human capital aged 15 years and above numbered 216,661 in 1995, with Kuwaiti females accounting for 145,690, and males for 70,971. The rate of inactive Kuwaiti males to the male population aged 15 years and over was 36.9 percent, whereas that rate for Kuwaiti females was 72.1 percent. However, these two rates for non-Kuwaitis were 5.1 percent and 39.6 percent, respectively, showing the significantly larger ratio of inactive Kuwaiti women, an indicator of cultural differences.

The high number of inactive Kuwaitis in 1995, mentioned above, can be distributed as follows:

a. 57.3 percent of these were students engaged in studying; 99 percent of these students were between 15 and 29 years of age.

b. 34.5 percent were females who chose to work at home only, despite the fact they receive the same or better education than men. In Kuwait, it is compulsory for children in the age group 6-14 to attend schools.

c. 8.2 percent were retired males or females.

Distribution of the Labor Force by Economic Sector

Each economic sector differs in how it combines factors of productions in order to achieve its output. Some sectors are more capital- or labor-intense than others. With respect to labor employment, most of the labor force in the Kuwait economy is concentrated in the social community and personal services sector, which not only includes public service, but also personal and household services. This service sector is considered the largest employer sector in the economy, employing 48.4 percent of the total labor force in 1995, 28 percent of which were Kuwaitis. The main activities of the service sector include public administration, sanitary services, education, health, social security and welfare housing and community services, recreational and cultural services, and personal and household services.

The National Account Statistics (NAS) 1979-1995 (1998) shows that employment in the service sector in 1995 was concentrated primarily in the last activity, personal and household services, which absorbed 55 percent of the total employment in that sector. NAS also indicates that the private sector share of employment in service activities increased from 48.4 percent in 1989 to 62.3 percent in 1995.

The PACI statistics shows that about 18.9 percent of the total labor force (22.7 percent of non-Kuwaiti workers) provide household services such as servants and other

related services. This confirms that it is not only the government decisions that cause the imbalance in the distributional structure of the labor force, but it is also the decisions made by individual households or members of the private sector that influence that structure significantly. Table 5 shows the distribution of the total labor force by economic sector, nationality, and sex.

Wholesale and retail trade is the second largest employment sector, absorbing 17.1 percent of total employment in 1995. Construction is next with 11.3 percent of the labor force, followed by the manufacturing sector, which employed 6.9 percent of the labor force. The transportation and finance sectors follow, sharing 3.9 and 3.4 percents of total employment, respectively. Because of the nature and the climate of Kuwait, the agriculture sector does not participate much in employment or national income. The oil sector, mining and quarrying, utilizes less than 1 percent of the labor force, as it uses highly intensive capital technology. The electricity and water sector, which is also can be considered a capital-intensive sector, has the lowest employment share.

During the boom in the 1970s, the demand for labor was very high, especially in sectors such as construction, transportation, and finance. This was because the government was channeling oil revenues to build the infrastructure, which affected employment in most sectors positively and significantly. The average annual growth rate of the labor force during that period was about 11 percent; expatriate labor accounted for most of that rate. Over the period of the 1980s, the demand for labor slowed down. The average annual growth rate of the labor force for the period from 1980 to 1988 was 5.78 percent. But the rate's growth began to accelerate by the end of the 1980s; the overall rate for the period 1980 to 1989 was 8.5 percent. This overall percent represents 7.87

percent for the Kuwaiti labor force and 9.73 percent for non-Kuwaiti labor. The employment in financial, wholesale and retail, and service sectors achieved the highest levels of average annual growth rates for the period with 20.11, 18.37, and 12.21 percents, respectively.

Even though most non-Kuwaitis fled from the country during the Iraqi invasion and there were many restrictions against entering Kuwait directly after its liberation, the average annual growth rate of the labor force achieved positive numbers for the period 1989-1995 for all sectors except electricity. The average annual growth was 2.6 percent for total employment, where Kuwaiti labor and non-Kuwaiti labor accounted for 6.37 and 1.99 percents, respectively. The construction and transportation sectors achieved the highest average employment growth rate for that period, which were 4.04 and 3.23 percent, respectively. These numbers are most likely due to the high demand for labor during that period to rebuild what was damaged and destroyed by the war.

It is noteworthy here to observe that in addition to the lower number of employees in the manufacturing sector, relative to other sectors, its employment share showed a declining trend, even thought it is increasing in absolute numbers. For example, it absorbed 13.69 percent of total employment in 1970, which then decreased to 8.39 percent and 6.9 percent for 1980 and 1995, respectively. Policy makers in Kuwait need to pay attention to and make decisions regarding this situation in order to support and provide the proper environment for this vital sector.

Table 5

Total Labor Force by Economic Sectors

Economic Sectors		1970			1975			1980			1985			1989			1995		
		K	NK	Total	K	NK	Total	K	NK	Total	K	NK	Total	K	NK	Total	K	NK	Total
Agriculture,	M	798	3,253	4,051	3970 ,	3,522	7,492	565	8,505	9,070	391	11,881	12,272	47	18,478	18,525	43	18,721	18,764
Hunting and	F	4	5	9	13	9	22	15	65	80	23	95	118	1	208	209	1	171	172
Fishing	T	802	3,258	4,060	3,983	3,531	7,514	580	8,570	9,150	414	11,976	12,390	48	18,686	18,734	44	18,892	18936
Mining and	M	1,627	4,828	6,455	1,767	2,953	4,720	1,802	4,637	6,439	2,219	4,699	6,918	2,866	3,878	6,744	3,284	3,745	7,029
Quarrying	F	48	668	716	12	127	139	33	187	220	39	293	332	79	466	545	217	348	565
	T	1,675	5,496	7,171	1,779	3,080	4,859	1,835	4,824	6,659	2,258	4,992	7,250	2,945	4,344	7,289	3,501	4,093	7,594
Manufacturing	M	6,100	25,876	31,976	2,237	21,889	24,126	2,274	38,265	40,539	4,088	45,194	49,282	4,340	57,054	61,394	5,765	63,383	69,148
Industries	F	9	106	115	21		341	65	656	721	131	1,144	1,275	132	2,106	2,238	258	3,035	3,293
	T	6,109	25,982	32,091	2,258	22,209	24,467	2,339	38,921	41,260	4,219	46,338	50,557	4,472	59,160	63,632	6,023	66,418	72,441
Electricity,	M	2,	5,106	7,236	2,029	5,230	7,259	1,821	6,294	8,115	1,492	5,989	7,481	2,232	9,062	11,294	3,096	3,441	6,537
Gas and Water	F	3	13	16	5	7	12	27	25	52	54	15	69	269	163	432	571	96	667
	T	2,133	5,119	7,252	2,034	5,237	7,271	1,848	6,319	8,167	1,546	6,004	7,550	2,501	9,225	11,726	3,667	3,537	7,204
Construction	M	2,186	31,418	33,604	1,755	30,357	32,112	422	96,103	96,525	692	119,328	12,020	471	93,537	94,008	579	115,613	116,192
	F	2	66	68	1	143	144	11	563	574	27	1,160	1,187	34	1,601	1,635	106	2,526	2,632
	T	2,188	31,484	33,672	1,756	30,500	32,256	433	96,666	97,099	719	120,488	121,207	505	95,138	95,643	685	118,139	118,824
Wholesale and	M	6,250	22,704	28,954	6,297	32,364	38,661	2,894	53,646	56,540	3,607	67,616	71,223	2543	144,838	147,381	2,643	167,128	169,771
Retail Trade, Rest-	F	25	304	329	30	868	898	55	1,822	1,877	121	3,354	3,475	182	7,446	7,628	409	9,988	10,397
aurants and Hotels	T	6,275	23,008	29,283	6,327	33,232	39,559	2,949	55,468	5,8417	3,728	70,970	74,698	2,725	152,284	155,009	3,052	177,116	180,168
Transportation,	M	2,357	9,640	11,997	4,305	10,853	15,158	6,066	22,605	28,671	6,209	29,128	35,337	3,227	28,888	32,115	4,407	33,427	37,834
Storage and	F	5	136	141	262	265	527	610	872	1,482	833	1,336	2,169	325	1,795	2,120	639	2,404	3,043
Communications	T	2,362	9,776	12,138	4,567	11,118	15,685	6,676	23,477	30,153	7,042	30,464	37,506	3,552	30,683	34,235	5,046	35,831	40,877
Finance, Insur-	M	1,092	3,507	4,599	1,295	4,548	5,843	2,234	8,645	10,879	3,026	14,158	17,184	2,823	28,509	31,332	3,327	28,247	31,574
ance, Real Estate,	F	13	289	302	82	598	680	337	1,470	1,807	696	2,608	3,304	902	3,408	4,310	1,561	3,051	4,612
Business Services	T	1,105	3,796	4,901	1,377	5,146	6,523	2,571	10,115	12,686	3,722	16,766	20,488	3,725	31,917	35,642	4,888	31,298	36,186
Social Commu-	M	34,838	53,371	88,209	56,011	72,203	128,214	40,962	124,205	165,167	48,473	164,615	21,088	66,995	206,388	273,383	92,496	205,086	2,975,82
nity and Personal	F	1,906	12,850	14,756	6,877	25,188	32,065	11,749	43,537	55,286	22,444	95,410	117,854	35,356	154,062	189,418	51,412	159,538	210,950
Services	T	36,744	66,221	102,965	62,888	97,391	160,279	52,711	16,742	220,453	70,917	260,025	330,942	102,351	360,450	462,801	143,908	364,624	508,532
Unclassified	M	236	559	795	4,701	1,090	5,791	1,881	4,406	6,287	970	4,482	5,452	3234	18,898	22,132	2,968	53,301	56,269
Activities	F	5	21	26	174	204	378	255	923	1,178	277	2,068	2,345	484	2,336	2,820	1,158	3,337	4,495
	T	241	580	821	4,875	1,294	6,169	2,136	5,329	7,465	1,247	6,550	7,797	3,718	21,234	24,952	4,126	56,638	60,764
Total Labor Force	M	57,614	160,262	217,876	84,367	85,009	269,376	60,921	367,311	428,232	71,167	467,090	538,257	88,778	609,530	698,308	118,608	692,092	810,700
	F	2,020	14,458	16,478	7,477	27,729	35,206	13,157	50,120	63,277	24,645	107,483	132,128	37,764	173,591	211,355	56,332	184,494	240,826
	T	59,634	174,720	234,354	91,844	212,738	304,582	74,078	417,431	491,509	95,812	574,573	670,385	126,542	783,121	909,663	174940	876,586	1,051,526

Source: *Annual Statistical Abstract*, different issues, Ministry of Planning (for 1985 and earlier).
Population and Labor force, PACI, Dec. 1989 and Jan. 1996 (for 1989 and 1995 data).

Distribution of the Labor Force by Occupation

The distribution of the labor force across occupations is an important indication about the structure of an economy, showing whether the economy is more industrial, agricultural or service-oriented.

Table 6 shows the distribution of total labor force by occupation and the employment share of each occupation over the period of 1970 through 1995.

In Kuwait, the average annual growth rate of the labor force was very high for all occupations during the 1970s; most occupations more than doubled their employment between 1970 and 1980. The rates for employment in professional/technical and administrative/managerial occupations were 20.54 percent and 24.91 percent, respectively, which reflects the high demand for these occupations. The share of Kuwaitis in the professional/technical occupations increased from 14.57 percent to 19.23 percent of total employment for the period between 1970 and 1980; however, the share for managerial and administrative positions declined from 34.33 percent to 32.23 percent of total employment for the same period, due to the change in the statistical consideration of "Bidoons." The production worker and laborer achieved the highest share of employment (37.5 percent) in 1980; however, Kuwaitis accounted for only 5.5 percent of them. Service workers came next by sharing 23.2 percent of the total employment, with Kuwaitis accounted for 16.1 percent. These figures indicate a significant discrepancy between the number of Kuwaitis employed in production occupations and in the service fields. The problem here is that there are no enough incentives for Kuwaitis to participate to any great extent in manual labor in addition to the lower social status for these jobs. The government has searched effectively for answers to the problem of the distribution of

indigenous labor between sectors and occupations, such as privatization and other structural changes.

Throughout the 1980s, the average annual growth rate in general slowed down. That rate for professional and technical occupations reached 7.04 percent. For the same period, administrative/managerial, sales and service occupations achieved the highest average rate of growth of employment, which was more than 14 percent.

During the period from 1989 to 1995, employment in many occupations achieved negative average annual growth rates; these occupations include sales, services, and agriculture. Production workers and laborers achieved the highest growth rate, which was 9.03 percent; this growth denoted a strong demand for labor in these occupations for that period. The laborers and transportation workers account for more than 62 percent of the employment in this occupation. The changes in demand for labor for this period reflect the effect of the Gulf War on the Kuwait economy.

Table 6

Labor Force by Occupation

Occupations	1970	1980	1989	1995
Professional and Technical Workers	25,622 (10.8)	78,261 (15.9)	127,832 (14.1)	135,044 (12.8)
Administrative and Managerial	1,780 (0.75)	6,214 (1.3)	14,322 (1.6)	19,889 (1.9)
Clerical and Related Workers	28,204 (11.9)	60,178 (12.2)	128,993 (14.2)	144,493 (13.7)
Sales Workers	21,093 (8.9)	31,038 (6.3)	71,815 (7.9)	62,589 (6.0)
Service workers	57,737 (25.3)	114,133 (23.2)	266,757 (29.3)	257,021 (24.4)
Agriculture Workers	3,943 (1.7)	9,826 (2.0)	19,189 (2.1)	11,627 (1.1)
Production Workers and Laborers	96,966 (40.8)	184,394 (37.5)	262,498 (28.9)	404,747 (38.5)
Persons Seeking Work First Time	2,410 (1.0)	7,465 (1.5)	18,257 (2.0)	16,116 (1.5)
Total Labor Force (100%)	237,755 (100)	491,509 (100)	909,663 (100)	1,051,526 (100)

Source: *Annual Statistical Abstract*, Ministry of Planning, 1990 and 1997.
Population and Labor Force, PACI, Dec. 1989 and Jan. 1996.

In 1995, the professional and technical occupation share of total employment was reduced from 14.1 percent in 1989 to 12.8 percent, whereas the Kuwaitis share was increased from 28.62 percent to 36.5 percent. This confirms the fact that Kuwait lost part of its highly skilled expatriate labor force; at the same time, it also reflects the government policy that supports building the human capital of the economy through different types of education and training programs.

The share of Kuwaitis also increased in clerical jobs (55 percent) and in sales (5.29 percent), service (8.5 percent), and in agricultural work (only 1.1 percent). However, surprisingly, the shares of Kuwaitis in the administrative and managerial occupations declined from 32.3 percent to 28.4 percent between 1989 and 1995, even though the share of total employment in these occupations increased from 1.6 percent to 1.9 percent for the same period.

The structure of an indigenous labor force across occupations in 1995 can be summarized in the following: clerical and related workers consist of 45.4 percent of Kuwaiti workers; 31 percent of these workers are female. The professional and technical workers come second by sharing 28.2 percent of the total indigenous labor force; 54 percent of them are female. The service occupation is ranked number three by absorbing 12.5 percent, with females comprising 13 percent of them. And, finally, production workers and laborers participate with only 6.7 percent of the total indigenous labor force. In a recent study about the manufacturing sector in Kuwait, Al-Humood (undated, p. 18) attributed this attraction of the indigenous labor force to clerical and administrative jobs to the following reasons: more authority, higher social status, less physical effort

required, less risky job duties, and the unavailability of adequate training and knowledge about production activities.

Production occupations play a much different role in the non-Kuwaiti labor force. The distribution of non-Kuwaiti workers across occupations in 1995 can be given as follows: the largest concentration is in production, with a share of 44.8 percent, most of whom are male. The second is the service occupation; 26.8 percent of the foreign labor force works in this occupation, with females accounting for 58.4 percent of them. These females usually work as domestic servants. Next in rank comes professional and technical jobs, which share 9.8 percent. Finally, clerical and sales occupations represent 7.4 and 6.8 percents, respectively.

The Role of Government

The government ownership of oil resources entitles it to play a major role in Kuwait's economic activities. In fact, the government assumed the responsibility of building a welfare state by providing free health care and educational services. It also subsidized some goods and services in an effort to redistribute the wealth. As a result of these responsibilities, the public sector has been expanding rapidly, absorbing about a quarter (24.5 percent) of the total labor force and producing more than 70 percent of the GDP in 1995.

The PACI statistics reveal that the existence of expatriate labor in the public sector declined from 20 percent in 1989 to 11 percent in 1995. The reduction comes from all occupations, each with a different rate. The occupations that experience a decline in immigrant labor, ranging largest to smallest percentage, include service,

production/laborers, managerial, and clerical. This diminishing number of non-Kuwaiti employees can be explained by the replacement of a non-indigenous with an indigenous labor force after the liberation of Kuwait, since for the same period the Kuwaiti workers in the public sector increased in all occupations. That shows reasonable progress in achieving the goals of the Kuwaiti migration policy. On the other hand, the existence of expatriate labor in the private sector increased in 1995, relative to 1989, in the following occupations: professional/technical, managerial, service, and production/laborers. However, it decreased in clerical, sales, and agriculture occupations.

With regards to government employment for Kuwaitis, the Kuwait Constitution, Article 41, states that "every Kuwaiti has the right to work and choose the type of his work." This is explained by the third clause of the same article, which says, "The State shall endeavor to make employment available to citizens and make its term equitable." Although the Constitution does not say that the government should "guarantee" jobs for Kuwaitis, as some have mistakenly understood, it does, however, leave that to government policy (World Bank, vol. III, p. 74.)

In the past, the government tried to accept all able-bodied Kuwaiti applying for employment in the public sector despite their lack of qualifications or fields of expertise, with only a short waiting period. However, in recent years the government has realized how costly this policy is and that it is impossible for the government sector to absorb all Kuwaitis applying for jobs without affecting the growing efforts to solve the problem of a budget deficit negatively. In addition to the financial consequences of the policy, it also had a directly negative effect on productivity in the public sector. The public wages and salaries item in the public budget (see Table 7) reached a large number and depleted a

sizeable portion of government resources. For example, the figure was 621.6 million KD in 1979/80, which increased to 882.9 million KD, then to 1,084.5 million KD in 1989/90 and 1995/96, respectively. As a percentage of total public expenditures, these figures consist of more than a quarter of the annual public expenditures.

The huge cost of the item of wages and salaries in the public budget induced the waiting period for employment to be much longer than before and created the emergence of unemployment phenomena, which is new in the Kuwaiti labor market. Government officials said that this is not a real unemployment because most of the unemployed did not receive enough education or training and also they do not accept certain jobs in the government. Two choices have been offered to the unemployed: either work in certain fields of the public sector such as the army, police or national guard, or to enroll in technical training programs (*Alwatan Newspaper*, 7-13-98).

The revised project of the Five-Year Development Plan 1995/96-1999/2000 states that "the government jobs are not a tool for wealth distribution but are efforts performed for wages, and are a part of the economic and social activity that the government sector exercises" (Planning Ministry, 1997, p. 113).

Table 7

Salaries and Wages in Public Expenditures

	Salaries and Wages	Total Public Expenditures	Share of Salaries and Wages
1969/70	114.3	299.6	38.15
1979/80	621.6	2423.7	25.65
1989/90	882.9	3,095.7	28.52
1995/96	1,084.5	4,126.5	26.62

Sources: Central Bank of Kuwait, *Kuwait Economy in Ten Years*, 1981
Central Bank of Kuwait, *Quarterly Statistical Bulletin*, different issues.

If the unemployed person is unable to work because he is ill or disabled, he is covered by social government programs and also by "Zakat," the Islamic annual charity for needy people to which most Kuwaitis willingly donate 2.5 percent of their wealth.

It is useful here to see how indigenous labor is distributed between the government sector and the private sector (including the joint sector, which consists of businesses owned jointly by the government and the private sector). Table 8 shows this distribution over economic sectors. The main conclusion from that table is that:

1. More than 90 percent of the Kuwaiti labor force was concentrated in government jobs across sectors and that the rate is slowly increasing over time.
2. More than 80 percent of total Kuwaiti labor is absorbed by the social community and personal services sector, where more than 99 percent of them work in the public sector.
3. The share of indigenous labor in the manufacturing industry was only 3.5 percent of the total indigenous labor force in 1995, and it had decreased over time. Also, the ratio of Kuwaitis employed by the government in that sector to total Kuwaitis in the same sector increased from 87.3 percent in 1985 to 89.51and 91.12 percents in 1989 and 1995, respectively.

Table 8

Indigenous Labor Force in the Government Sector

Sectors	1985			1989			1995		
	Gov.	non-Gov.	Total	Gov.	non-Gov.	Total	Gov.	non-Gov.	Total
Agriculture	186	228	414	0	48	48	0	44	44
Mining	2,138	120	2,258	2,923	22	2,945	3,464	37	3,501
Manufacture	3,683	536	4,219	4,003	469	4,472	5,492	531	6,023
Elec.	1,546	-	1,546	2,501	-	2,501	3,667	-	3,667
Construction	0	719	719	0	505	505	0	685	685
Wholesale & Retail Trade	220	3,508	3,728	29	2696	2,725	91	2,961	3,052
Transportation	6,609	433	7,042	3,241	311	3,552	4,430	616	5,046
Finance, Insurance	973	2,749	3,722	1,041	2,678	3,725	1,443	3445	4,888
Social Community	70,427	490	70,917	101,770	581	102,351	143,209	698	143,907
Unidentified Activity	-	1,152	1,152	-	880	880	-	1,619	1,619
Total	85,782	8783	94,565	115,513	8,190	123,703	161,796	10,636	172,432

Sources: *Annual Statistical Abstract*, Ministry of Planning, 1997.
Population and Labor Force, PACI, Dec. 1989 and Jan. 1996.
Note: Total labor force doesn't include those persons seeking work for the first time.

The distribution of Kuwaiti workers between public and private sectors became a major concern for both the government and the national assembly in recent years, although many researchers confirm that the percentage of the indigenous labor force in the private sector is much larger than statistics indicate, a point Sirageldin and Khorshid (1996, pp. 59-60) make, noting that the Kuwaiti existence in the private sector is much larger than statistics show. And that existence is implied from practiced Kuwaiti law that required a Kuwaiti owner or co-owner in the management of working Kuwaiti firms and that there is a large proportion of Kuwaiti workers who have second jobs in the private sector.

Al-Ebraheem estimated the percentage of the indigenous labor force in the private sector to total indigenous labor force to be no less than 40 percent since there is a direct and indirect economic correlation between indigenous labor in the public sector and the private sectors (Al-Ebraheem, 1995, p. 26).

Many reasons motivate Kuwaitis to work more in the public sector relative to the private sector. The main factors include: higher wages (for less-educated Kuwaitis), more opportunity to be promoted, more stable and secure jobs, and also more flexibility in performing job duties (Al-Humood (undated), p. 17-18).

The wage structure between private and public sectors in 1985 was generally biased toward the public sector. The average government wage is 50 percent more than the average private wage for all educational levels of labor except those who hold university degrees. However, the average wage in the private sector is higher than the public average wage for laborers who hold university degrees by about 22 percent. Table 9 shows the average wage in the public and private sectors across educational levels of labor in 1985.

Some studies conclude that the wage in the government sector in Kuwait was not only affected by economic factors, but also by social and political factors. For example, un- and less-educated Kuwaitis can not compete with non-Kuwaitis in a free labor market. As a result, the government tries to protect this segment of Kuwaiti labor force by offering a higher wage than private sector (Al-Quisi, 1996, p. 26).

Table 9

Average Wage in KD in the Government and Private Sectors by Educational Level in 1985

Educational Level	Sector	
	Government	Private
Illiterate	250.92	145.6
Read and Write	293.7	150.0
Primary	315.9	211.1
Intermediate	329.4	221.3
High School and Equivalent	344.7	290.0
Over High School and Below University	370.2	248.5
University	469.2	570.6

Source: Al-Quisi, Issa, *Population and Labor in the Kuwait Economy, the Problem and Policy*, 1996.

The policy that the government pursued in the past regarding the employment of Kuwaiti labor not only created a financial cost, but also had the effect of distorting the allocation of human capital resources between the public and private sectors. The concentration of indigenous labor in the public sector, with its higher wage rate, is likely to enhance the dependency of the private sector on expatriate labor. The private sector cannot compete with the financially and legally more powerful public sector. This can explain a large part of the dilemma of the high dependency of the economy on expatriate labor that the government targeted but failed to solve.

The government has to find a comprehensive solution to the problems of the labor market and Kuwaiti employment. Any delay will only worsen the problem since the output of the educational system in the future, which is large relative to the capacity of public sector, must be taken into account.

The practical actions of the government occurred as follows: on one hand, the government adopted the policy of privatization in order to reduce the size of the public sector by transferring public projects to a joint sector where the majority of these projects

would be owned by the private sector. The World Bank was asked to study the Kuwait economy and give its suggestions about the privatization strategy.

In October, 1993, the World Bank provided a list of 74 projects that were candidates for privatization. Examples of these projects include telecommunications, electricity and water, Kuwait Airways, and petrochemicals. More importantly, the World Bank suggested a structural reform program to implement the market-based economy. In this reform the government had to end the full-employment policy for Kuwaitis in the government sector, and it also had to create an incentive system to encourage Kuwaitis to search for employment in all sectors of the economy (World Bank, Vol. III, p. 80).

On the other hand, the government issued a revised version of the Five-Year Development Plan 1995/96-1999/2000 in January 1997. This plan called for a structural reform of the economy and released market forces to allocate human and natural resources. It also asked for invigoration of the competition by diminishing the dominance of the public sector over economic activity. The basic structures of this reform are:

1. Reinforcing the role of the private sector, which required a reform of economic and financial laws to achieve the objectives.
2. Achieving and maintaining economic stability by reinforcing investment opportunities in productive activities, animating the financial market, and stabilizing domestic prices.
3. Stimulating the growth of economic activities.

A bundle of fiscal and economic policies is expected to be released by the government officials after approval from the National Assembly of Kuwait.

The revised Plan, in the time remaining, will try to prepare the economy for structural reform and achieve the following with regards to organizing the labor market:

1. Legislate the rate of employment of the indigenous labor force in the government sector and freeze it at its current size.
2. Reduce the rate of employment of expatriate labor in the private sector by increasing the cost of expatriate labor and other requirements for this kind of labor.
3. Increase the capacity of the private sector to indigenous labor.

The government believes in a gradual implementation of fiscal and economic reform; in the last few years, it has taken a number of actions in that direction. For example, a 10 percent replacement rate for expatriate labor has been pursued in the public sector, the privatization process has been gradually followed, and the change in the pricing of public goods and services, such as health care, electricity and gasoline, is noticeable.

Privatization, or the structural reform that gives the private sector a bigger role in the economy, is supposed to improve the productivity of labor, and both enhance the efficiency of the public sector and relieve its deficit. However, this process is not expected to be painless, since unemployment among Kuwaiti citizens is also expected to prevail, at least in the short term. It was expected that as many as 4,649 employees would lose their jobs from privatizing only the following projects: telecommunication, electricity and water, port authority, and the Kuwait Airway (World Bank, vol. III, p. 81). Short run unemployment is inevitable in any dynamic society, but in the long run the government should design effective migratory, employment, and education and training

policies with the cooperation of the private sector to achieve the economic aspirations of the Five-Year Plans.

The government should help to enhance the capacity of the private sector in order to generate new jobs there, but it should not guarantee jobs in the public sector. On the other hand, the Public Institution for Social Security or other government institutions should take care of the unemployed and of those who will lose their government jobs, but it should not distort the Kuwaitis' incentives to work by creating a reliance on government social benefits under that Institution.

For these processes to succeed, the wage differential between the public and private sectors should be eliminated or at least reduced. Then the supply of expatriate labor should be under control, especially for those who can be replaced by the Kuwaiti labor force.

Recently, useful suggestions have been made by a cooperative study conducted by the Kuwait Institute for Scientific Research (KISR) and the World Bank. They suggested imposing yearly fees for each expatriate laborer as a temporary financial source to support indigenous labors working in the private sector or becoming unemployed. They also proposed a 20 percent reduction in the wage of any new employee in the public sector (*Al-qabas Newspaper*, 7-11-99). Imposing fees on expatriate labor will lead to a higher cost of migration to Kuwait, which is expected to work as a selective device for skilled laborers because only higher-wage labor can afford such fees. It can also reduce extravagance in the household consumption of luxurious labor services.

Finally, retraining those who lose their government jobs in the privatization process to meet the demand of the private sector is important. To do so effectively, the

educational and training system should be modified according to the actual demand of the labor market.

Education and the Labor Force

The Education System in Kuwait

Education and training are the basic building blocks for the human capital of a nation. Efficient education and training systems can improve the productivity of labor and achieve the economic and social goals of the development plans. Three levels of education will be discussed in this section: general education, applied education and training, and university education.

A. General Education

General education provides the base upon which many other types of education must be built. It employs a high proportion of government employees and costs much more than all other types of education combined. The role of this general education is to produce both a higher quality and quantity of students who proceed to higher education and a higher quality of students who move directly to the labor market.

Even though the systematic education in Kuwait started with the opening of the first elementary school, "Al-Mubarakia," in 1912, the first Board of Education was formed in 1936, which announced the responsibility of the government in terms of educational spending. The early stage of education in Kuwait began with the support and help from Egyptian and Palestinian scholars.

The first secondary school and the first girls' elementary schools were established in 1936-37. Since then, there have been considerable quantitative and qualitative improvements in the educational system.

The compulsory education law of 1965 required that all Kuwaitis between ages 6 and 14 attend school. The government aimed to turn the traditional society into a modern one through enormous investments in public schools. The public expenditure in education accounted for about one fourth of the government's final consumption expenditures, and more than 3.2 percent of the GDP in early 1970s.

The educational system adopted three stages of education since 1956; primary, intermediate, and secondary, where each stage lasts for four years and is preceded by two years of kindergarten. In the last two years of secondary education, students must choose between the Arts and the Sciences as fields. A new "choice of courses" system of secondary education was introduced in 1978-79, along with the regular secondary school system of the public schools. It is more flexible so that it allows students to choose courses that are closer to their interest. This system tried to avoid the weakness of the regular system of secondary education by considering the differences between students and allowing them to choose their fields and courses according to their interests and abilities. It focuses on the concepts and applied technical fields instead of only theoretical ones; thus, it is closer to the labor market demands than the regular system. Moreover, it stimulates students toward self-education and searching for information (Al-Muhanna and Bahbahani, pp. 128-129).

By 1993-94, Kuwait had 126 kindergartens and 568 primary, intermediate, and secondary public schools. Teaching staff numbered 22,847 male and female instructors,

with Kuwaitis accounting for 57.4 percent of them. Enrollment in general education in 1993-94 was 265,210 students, of which Kuwaitis comprised 86 percent (Ministry of Education, 1993-94).

In addition to general education, other specific education exists, including education of the following types: adult, handicapped, religious, and private education.

In the past, the government provides free education with free books and school supplies, uniforms, and meals for all nationalities in public schools. However, with the large influx of foreigners, priorities were given first to Kuwaiti children, and then to the Gulf States' children, since the systematic education in Kuwait started earlier than in their countries; next in line were the children from other Arab countries (Alessa, p. 60). However, due to the escalation of public expenditures on education and to the budget deficit, many provisions have been removed from the government's burden, even for Kuwaitis, such as the uniforms and meals.

The change in government policy regarding the enrollment of non-Kuwaitis in public schools in the 1990s can be seen in a comparison of their enrollment in public schools before and after the Kuwait liberation war. For example, the non-Kuwaiti student enrollment in 1989-90 was 163,961 students. This number dropped to 41,747 students, which reflects a 75 percent reduction in enrollment, even though the reduction in the non-Kuwaiti population was only 18 percent for the same period. This change in government policy reflects its efforts to reduce the cost of expatriate labor and relieve the budget deficit. Most of the non-Kuwaiti population enrolls their children in private schools, where the financial responsibilities are transferred to the employers or the parents.

B. Applied Education and Training

In addition to general education, the government provides technical and vocational education. Starting in 1982, many of the colleges and training centers were integrated under the supervision of the Public Authority for Applied Education and Training (PAAET). This authority consists of two main sections: the Applied Education section and the Training section. The Applied Education section consists of four colleges: Technical Studies, Basic Education, Commerce, and Health. The studies in these colleges take two to three years and grant a diploma, except Basic Education, where the study lasts for four years and provides a B.A. degree. The Training section includes telecommunication, electricity and water, and two industrial and nursing institutes, in addition to parallel education and an on-the-job training center. Construction and Secretary institutions are expected to open very soon. The period of study for these institutions is two years or less to provide a diploma or a certificate of training.

Through the Applied Education section, the PAAET prepares students in the technical, teaching, health, and commercial fields. It provides the labor market with semi-skilled labor, with the exception of basic education, where its graduates are considered skilled labor. The output of PAAET is viewed as an important segment of the labor force for the economy.

The total output of PAAET in 1982-83 was 2,617 graduates, 61 percent of whom (1,598) were from the four colleges mentioned above. The technical and health science graduates accounted for 19 percent. Over time, the total output rapidly increased until it reached 44,444 graduates in 1994-95, where the four colleges represent 60 percent (PAAET, 1994-95).

Even though the government encourages Kuwaiti students enrolled in technical and vocational education with financial subsidies and other provisions, the students continue to hesitate to enroll in these programs because they perceive these jobs as being low in social status. Moreover, the student dropout rate has been high in these institutions; 18.5 percent in 1985-1986 (Muhanna and Bahbahai, pp. 128-129). This required an immediate solution once the reasons had been identified. Pursuing a privatization program and structural reform will definitely have an impact in increasing the demand for this type of education.

C. University Education

Kuwait University was established in 1966-67 with two colleges, Science and Arts. It has since expanded and improved to provide students with a wide variety of fields (nine colleges), which are: engineering, medicine, allied medicine, sciences, arts, education, administrative sciences, law, and Islamic Studies, or "Sharee'a." Students can obtain a B.A., M.A., or Ph.D. in most of these fields. Kuwait University provides the labor market with different types of skilled labor, also, the Community Services and Continuing Education Center belonging to the university trains labor in different fields. The output of Kuwait University in 1970-71 was 336 graduates from four colleges; of these, Kuwaitis comprised 79 percent. Only 11 percent of these graduates were from the Scientific Colleges.

In 1980-81, there were 1,663 graduates representing six colleges; Kuwaitis comprised 67.1 percent, with the share of graduates from the Scientific College increasing to 25 percent. The number of graduates grew to 2,046 from nine colleges in

1994-95; Kuwaitis accounted for 92.9 percent of them, but the share of graduates from the Scientific College was almost the same as in 1980-81, 25.2 percent (Ministry of Planning, 1990 and 1997). These statistics, the output of the education system through the last two or three decades, affected the structure of the indigenous labor force significantly, which is shown in the next section.

Total Labor Force by Educational Level

Kuwait has two main sources of labor supply: the output of the educational system and expatriate labor. The former source required a great deal of investment in human capital, which starts from the early years of child development, whereas the latter is supposed to be ready to participate in the labor force, immediately upon arrival.

The characteristics of the indigenous labor force have tremendously improved in the last two decades due to the emphasis that the government has placed on building human capital through educational and training programs to achieve the goals of the Economic and Social Development Plans. For example, the educational services cost in the last government budget (1996-97) was 521.6 million KD, which absorbs 13.4 percent of total government expenditures. Considering that most of physical capital has been built in the last two decades, that number represents a large cost.

Table 10 shows the distribution of the labor force by educational levels, nationality, and sex from 1970 to 1995. In 1970, uneducated Kuwaiti labor (both the illiterate and those that can read and write) accounted for about 76 percent of the total indigenous labor force. That rate was reduced to 42.6 percent in 1980, then to 7.8 percent and 6.2 percent for 1989 and 1995, respectively. Uneducated expatriate labor also

decreased between 1970 and 1989; however, their share in total expatriate labor increased from 39.1 percent in 1989 to 44.8 percent in 1995, which could have been avoided or at least alleviated after the Kuwait liberation by pursuing a selective policy of expatriate labor.

Table 10

Distribution of the Labor Force by Educational Levels

Educational Levels		1970			1980			1989			1995		
		K	NK	Total	K	NK	Total	K	NK	Total	K	NK	Total
Illiterate	M	28745	58940	87685	25469	96910	122379	3859	115580	119439	3832	99370	103202
	F	493	4762	5255	753	13679	14432	704	24192	24896	984	24162	25146
	T	29238	63702	92940	26222	110589	136811	4563	139772	144335	4816	123532	128348
Read and Write	M	20269	52935	73204	17442	89993	107435	4798	125248	130046	5303	197768	203071
	F	139	1732	1871	398	8028	8426	495	41174	41669	701	71696	72397
	T	20408	54667	75075	17840	98021	115861	5293	166422	171715	6004	269464	275468
Primary	M	6552	12791	19343	12702	25818	38520	10055	80058	90113	14328	82737	97065
	F	188	391	579	718	1210	1928	1472	17342	18814	2098	11659	13757
	T	6740	13182	19922	13420	27028	40448	11527	97400	108927	16426	94396	110822
Intermediate	M	3985	9796	13781	17304	32162	49466	29021	108673	137694	39282	126356	165638
	F	290	796	1086	2946	1952	4898	7927	26732	34659	11653	24328	35981
	T	4275	10592	14867	20250	34114	54364	36948	135405	172353	50935	150684	201619
Secondary	M	2572	16686	19258	11642	50252	61894	26759	117301	144060	38569	127764	166333
and Below	F	695	4360	5055	6246	13754	20000	16485	44049	60534	23301	36763	60064
University	T	3267	21046	24313	17888	64006	81894	43244	161350	204594	61870	164527	226397
Graduate	M	1152	10804	11956	5086	37165	42251	14286	62668	76954	17293	57968	75261
and Post	F	249	2479	2728	2768	9647	12415	10681	20096	30777	17593	15720	33313
Graduate Degree	T	1401	13283	14684	7854	46812	54666	24967	82764	107731	34886	73688	108574
Not Stated or	M	39	334	373					2	2	1	129	130
Newly	F	1	21	22					6	6	2	166	168
Unemployed	T	40	355	395					8	8	3	295	298
Total	M	63314	162286	225600	89645	332300	421945	88778	609530	698308	118608	692092	810700
	F	2055	14541	16596	13829	48270	62099	37764	173591	211355	56332	184494	240826
	T	65369	176827	242196	103474	380570	484044	126542	783121	909663	174940	876586	1051526

Sources: *Statistical Abstract in 25 Years*, Ministry of Planning, 1990.
Population and Labor Force, PACI, Dec. 1989 and Jan. 1996.
Note: 1980 data exclude newly unemployed.

On the other hand, the share of the highly educated (graduate and post-graduate) indigenous labor force in the total indigenous labor force was only 2.14 percent in 1970, but improved continuously until that ratio reached 19.94 percent in 1995. That improvement in the quality of the indigenous labor force can be attributed to the educational system, mainly Kuwait University. The average annual growth rate of the

supply of this segment of indigenous labor was very high during the 1970s and 1980s, 46.06 percent and 24.21 percent, respectively. However, it slowed down between 1989 and 1995, dropping to 6.62 percent, because the number of the Kuwaiti workers who are graduates and post-graduates became larger in recent years.

The supply of expatriate labor that hold graduate and post-graduate degrees increased during the 1970s and 1980s. The average annual growth rate of this group was 2.52 percent and 8.53 percent, respectively. However, that rate became –1.83 percent for the period 1989-1995, which meant that Kuwait lost some of its highly skilled immigrant labor after the war.

The supply of semi-skilled labor, the output of PAAET and high school, increased during the 1970s and 1980s, which is reflected in the share of indigenous labor who are high school graduates or hold diplomas, in the total indigenous labor force. That rate was only 5 percent in 1970, then grew to 17.3 percent, 34.17 percent, and 35.37 percent for 1980, 1989, and 1995, respectively. The average annual growth rate of that segment of labor was 44.8 percent during the 1970s, then it reduced respectively to 15.8 percent and 7.2 percent for the 1980s and the first half of the 1990s.

The supply of semi-skilled expatriate labor also increased continuously for the period from 1970 through 1995. The share of semi-skilled expatriate labor in the total expatriate labor force was 11.9 percent in 1970, then increased to 16.82 percent and 20.6 percent in 1980 and 1989, respectively. That share reduced to 18.8 percent in 1995.

From this analysis, the effect of the educational system on the indigenous labor force is very clear. The supply of uneducated indigenous labor achieved negative growth rates continuously for the whole period of the study. On the other hand, the supply of

highly educated and semi-skilled indigenous labor achieved positive growth rates over the whole period.

By comparing the supply of expatriate labor before and after the Kuwait liberation, it is important to note that the uneducated segment of expatriate labor grew by 4.72 percent, whereas the highly skilled expatriate labor achieved a negative growth of -1.83 percent for the same period, which offsets the improvement in the quality of the labor force.

Even though the educational system in Kuwait has a great impact on the structure of the indigenous labor force, there exists a mismatch between the output of that system and the requirements of labor market which has appeared in recent years and has become a major concern for economic planners and policy makers in Kuwait. The conflict between the supply of and demand for labor is relatively small in scale, but it is vital in explaining the existence of unemployment in the Kuwaiti market in the future.

The general criticism about the educational system in Kuwait, as in many developing countries, is that it is biased in favor of the arts, humanities, and other soft sciences at the expense of engineering, medical, and other hard sciences. For example, Kuwaiti medical doctors and scientists account for only 20.8 percent of total doctors and scientists in Kuwait, and Kuwaiti engineers represent only 17.4 percent of total engineers as of 1995. This confirms the inadequate supply from Kuwait University in such fields to satisfy the demand of labor market.

On the public sector side, there is a shortage in the output of certain colleges such as Engineering, Medical Sciences, and accounting; however, there is a surplus in the

output of other colleges, such as Art, Sharee'a, and Basic Education (*Al-watan Newspaper*, 10-6-98).

The technical training program faces a similar shortage problem, as the PAAET is unable to attract enough Kuwaiti students to these programs. The social status of vocational training, better opportunities elsewhere, and the existence of non-Kuwaitis in these jobs may cause this result. However, the government needs to fight this misconception about vocational training by creating the proper environment for these graduates, providing enough information and effective incentives for Kuwaiti students to enroll in these important occupations.

The success of government policy in fighting unemployment or the mismatch between the output of educational system and the actual demand depends on the government implementation of restricting expatriate labor inflow, expanding the capacity of private sector and improving the educational institutions' curriculum. It is essential for the educational and training system in Kuwait to reflect the demand for labor in the economy to achieve the actual goal of that system. Also, to reduce the cost of the privatization program, Kuwaiti labor unemployed because of the privatization process have to be retrained so that finding a job in the private sector will be easier.

The government plays a vital role in supporting the accumulation of indigenous human capital. It should play the same role in providing market-oriented development strategies for better Kuwaiti economic performance in the future.

CHAPTER III

LITERATURE REVIEW

Labor Migration: Theoretical and Empirical Overview

Labor migration experiences changes in direct correlation to the "push" and "pull" factors of the economy, politics, and social construct of home and host countries. Labor immigrants usually base their decision to migrate on the income differential between home and host countries. Three main theoretical views exist regarding the relationship between migration and development.

First, migration benefits both sending and receiving countries because it allows for an efficient use of labor, a factor of production, by moving from less to more efficient uses or from low to high wage countries. This is the argument of the neoclassical school of economics. Proponents of this view believe that labor migration flows in the same way trade and capital flows, which offers great benefits to both the home and host countries (World Bank, 1995, p. 64). The impact on the sending country is expected to be lower unemployment, higher wages, and more economic growth. The reason for this expectation stems from the home country receiving workers' remittances from abroad; and also, these workers will return home with training and experience. Through migration, the receiving country can overcome the labor shortage "bottleneck" and expand the level of employment. The wage rates are expected to fall and the growth rate

will rise. According to this school of thought, the process of migration is assumed to bring convergence between the sending and receiving countries.[3]

The opposing or divergent school of thought believes that the highly educated labor force most likely tends to migrate, leaving the sending, "less developed" countries with less-skilled workers, referred to as "brain drain." The benefit of migration will go to receiving or "more developed" countries since they have more economic and political power. Unlike the neoclassical school's thinking, this view suggests a divergence instead of a convergence between sending and receiving countries.[4]

The third school of thought believes that the relationship between migration and development remains unsettled or uncertain, due to the existence of pros and cons in respect to the migration impact. According to this view, the impact of migration should be studied case-by-case (Hermele (1997), p. 134.) Hermele (1997) argues that for migration to stimulate development, certain environments in the structural features of the economy must first exist. For sending countries, these are diverse economic structures, an adequate supply of labor, and a well-functioning financial system to channel remittances to productive uses (Hermele, 1997, p.40). Fischer, Martain and Straubhaar (1997) review a number of empirical studies about migration and development in both developed and developing countries, concluding "migration has had positive short-term effects for sending and receiving countries. With respect to the long-term effects, especially in terms of the development prospects for "southern" countries, the bulk of the empirical studies suggest that migration normally had little impact on the development

[3] For some details, see World Bank (1995) Chapter 10.
[4] For some details, see Hammar, Brochmann, Tamas, and Faist (1997) Chapters 4 and 5.

process, and, if anything, enhanced development convergence rather than divergence" (Fischer et. al., 1997, p. 131).

Briggs (1996) focuses his study on the host country, basing his analysis of the impact of immigration on the receiving countries on three issues: efficiency, equity and social policy development. The first, efficiency, means that immigration should be promoted if it enhances the efficiency of the labor market. This suggests admitting skilled labor that is difficult to generate in the short run and costly to increase in the long run. However, unskilled labor should be limited.[5] The second, equity, means that the policy makers should be concerned about the consequences of the immigration policies on each segment of the labor force. For example, policy makers must determine who benefits and who loses from migration policy in either the short or long runs. The third, the impact on social policy is also a major criteria to analysis the impact of immigration policy on the receiving countries. For example, the unemployment could be generated as a result of a free market, which in turn requires social programs to support them with basic needs such as health care, education, and other services.[6]

Some Relevant Migration Studies

The Kuwait economy attracts immigrant workers from a wide number of countries. These migrant workers are usually interested in the wage differential between Kuwait and their home countries, in addition to the social services that the Kuwait government provides. Thus, the Kuwaiti labor market is characterized by its absorption of a high percentage of migrant labor.

[5] He cited the U.S. as an example for restricting the unskilled labor inflow by 10,000 employment-based visas a year since 1990.
[6] Examples from European countries that applied such programs have cited.

In Chapter II, the structure of the Kuwait population and the labor force was discussed. In this section, some studies that concern the impact of migrant labor on the Kuwaiti economy will be reviewed. Shah (1995) studies the structural change in the labor force in Kuwait as a receiving country to migrant labor. After reviewing the past and present trend of indigenous and migrant workers, she expects a continuing high dependency of the Kuwaiti economy on foreign workers for the long term, especially on those employed in low social and low-wage jobs.

The impact of these workers on the economy is studied by McLachlan (1985), who shows that the foreign workers in Kuwait contribute heavily to economic sectors. He attempts to measure the contribution of these workers to the national income by using a simple formula; his results show that approximately 26 percent of the total GDP in 1980 as a net (after accounting for their consumption and their remittance abroad) contributed by foreign workers. His assessment shows a large return for migrant workers; at the same time; however, the result of his study indicates a heavy financial cost in addition to cultural and social costs.

Looney (1993) also studies the cost of the foreign population in Kuwait using an econometrics analysis. In his models, he first estimates the foreign population's demands on public services (education, health, and other services); he then estimates the relative contribution of Arab and Asian populations in the second model. In his last model, he regresses services against expected and unexpected government expenditures in addition to each ethnic group. Looney's conclusion here supports McLachlan's (1985) findings that migrant labor has a large cost potential for Kuwait. Moreover, he found that most of the cost coming from Arab workers (e. g. Palestinians and Jordanians) since they have

more access to public services and have higher dependency rate than other non-Kuwaiti sub-populations.

Computable General Equilibrium Models

Having analyzed the labor market in Kuwait in the previous chapter and reviewing some theoretical and empirical literatures about migration, we now must shed light on the tools used in this analysis. One of the principal tools being used in the present study is the Computable General Equilibrium model. The analytical framework of the present day Computable General Equilibrium models can be historically traced back to the works of L. Walras (1874) and Edgeworth (1881). Since empirical economists and policy makers are not interested in the abstraction of general equilibrium models, the present-day studies have been attempting to convert the abstraction to applied general equilibrium models to realistically fit the world in which we live. As a result, several studies have been carried out by Arrow and Debreu (1954, 1959), Scarf (1967, 1973), and Arrow and Hahn (1971) to convert the so called abstracts of the Walrasian general equilibrium[7] to realistic models of actual data (applied studies).

L. Johnsen (1960) developed the first empirical CGE model. He linearize his model (in logarithms), then solve the rate of change in prices and production by using simple matrix inversion. The base-year values of prices and quantities are used to predict the economy performance in the future. The concern of the study was the resource allocation in the Norwegian economy.

[7] The concern of the theoretical general equilibrium studies is in the existence, uniqueness, stability, and optimality of the general equilibrium solution.

During the 1960s there were some CGE models built by Harberger (1962) and others, but since the 1970s the use of these models for policy analysis became widespread in both developed and developing countries.

The emerging empirical models are called Computable General Equilibrium (CGE) or Applied General Equilibrium (AGE) models. These models have been used as a major and powerful tool for evaluating alternative economic policies in a wide variety of contexts and in vastly different economic fields.

Definition

The CGE model is " an approach which attempts to simulate numerically the general equilibrium structure of an economy" (Greenway, Leybourne, Reed and Whalley, 1993: pp. 3). Greenway, et al. have prescribed a two-step procedure for CGE models: the first step is setting the structures of the model that fit the actual features of the economy concerned. That includes the functional forms, the level of aggregation, the collection of data, and the calibration of the model's parameters to the data set. The second step is solving the model by using a computer algorithm. Because of the use of the actual data from the real world, the application of CGE models (to developed and developing countries) is not uncommon. Further, there are some unique common denominators of CGE models that are applied to developed and developing countries. These are catalogued by Dixon and Parmenter (1996) as follows:

1. They are *computable* in the sense that a numerical database is used for certain countries or regions to produce numerical results. Input-output tables, national accounts, and social accounting matrices are usually the database sources for these models.

2. They are *general* in the sense that they deal with the behavior of several economic factors explicitly, such as profit maximization for producers and cost minimization for consumers.
3. They employ market *equilibrium* assumptions so that the prices in these models will adjust to clear all markets simultaneously, which reflects the Walrasian general equilibrium.

Rationale for CGE Models

The main advantage of the CGE approach is in its solid micro-foundation, ability to account for the "feedback" effect of a particular policy and depicting the interactions between different markets and different sectors in the economy. In addition to explicit functional forms that aid the evaluation of the impact of alternative policy interventions, CGE models are highly mathematically sophisticated. Analyzing the effects of shocks without any historical data is a hallmark of the CGE models. No wonder economists are racing to use CGE to give empirical flavor to their postulates, theories, and laws.

Input-Output, Linear Programming, and the CGE Models

Input-Output (I-O) models are considered linear multi-sector planning models, which were pioneered by Wassiley Leontief. The basic material balance equation of the Input-Output model is the following equation.

$$\Delta X = (I - A)^{-1} \Delta F \tag{1}$$

where ΔX is the sectoral change in production levels as a result of a change in the final demand, ΔF. The coefficient matrix A represents the matrix of average input (purchase) coefficients by industry, and I is the identity matrix; both compose the Leontief inverse

matrix, $(I-A)^{-1}$. The main strength of these models is that they capture the interrelations between economic sectors, allowing sectoral production requirements to be projected, given final demands. (For details about the uses of the I-O models, see Chowdhury and Kirkpatrick (1994), p. 28, and Dervis et al. (1982), Chapter 2.)

The recent CGE models took the advantages of the I-O models and extended them to build highly nonlinear models. The behavior of several economic sectors have been introduced through CGE models by using different functional forms of production and consumption, such as Cobb-Douglas (CD), constant elasticity of substitution (CES), and the linear expenditure system (LES). (For some details about choosing the functional forms, see Shoyen and Whalley (1992), p. 94.) Unlike I-O models that assume no substitution among factors of production and consumption goods, they allow for substitutions between variables.

Dixon and Parmenter (1996, p. 67) examine the disadvantages of the I-O models, arguing that because I-O models do not link industries via economy-wide constraints, such as budget or trade deficits and availability of factors of production, the effect of each industry on another will not be accurate.

Linear programming (LP) is a mathematical programming (planning) model in which the relationships (and constraints) are expressed in linear form. (For more details, see Chowdhury and Kirkpatrick (1994), and Dervis et al. (1982), Chapter 3.) LP is superior to I-O models in their concern about "optimum" allocation of resources and the efficiency in the use of these resources. The LP models introduce a great deal of flexibility to the I-O model by incorporating inequality constraints and explicit maximization of objective functions to the I-O models. These models allow the modeler

to add a specific inequality constraint to reflect a particular feature of the economy. Unlike the I-O approach, they can deal with quantitative solutions as well as values. Being linear is one of their weaknesses, but because of their features, Dervis et al. (1982) treat them at least as a first approximation to the CGE models, even though both I-O and LP models are not well suited for mixed economic systems. This is because in these countries various economic actions have an impact on resource allocation. Despite the modifications on these linear models, they do not directly incorporate the price-incentive variables that represent the essential tools of planning and policy makers in mixed economies (Dervis et al. (1982), p. 132).

These models are mostly suited for centrally planned economies, where prices are not endogenously determined. However, the CGE models are more suited to the policy analysis in most developing economies, which explains their popularity in these countries for more than two decades.

Partial Equilibrium vs. General Equilibrium

The partial equilibrium analysis is an approach that estimates the impact of one variable on (an)other variable(s) based on *ceteris paribus* assumption. It deals with only one market at a time and ignores the feedback between demand and supply to endogenize relative prices or quantities.

Whalley (1975) compared a simple and extended partial equilibrium model with a Computable General Equilibrium model (CGE) for a removal of distortionary capital income taxation in the UK economy. To check the robustness of the result, an alternative values for production function elasticities are used in the model. The result shows that partial equilibrium techniques act erratically as an approximate method. The CGE model

might be criticized for being complex, but it is more satisfactory. On the other hand, the virtues of the partial equilibrium analysis lie in its simplicity and lower cost; but its expense, however, is reliability. To clarify the advantages of the CGE approach over the other, an example about trade restriction and tariff is given by Bandara (1991, p. 4). In partial equilibrium analysis, a change in the tariff rate is assumed to have its effect in a particular industry. However, this is not the whole story since a change in relative prices leads to a change in resource allocation, so that production, employment, investment, consumption, trade balance, and many other macroeconomic variables will be affected by a change in the tariff rate. The CGE models overcome this weakness and enable the indirect effect of a change in policy, external, or internal shocks in macroeconomic variables to be captured along with the direct effect.

Macroeconometric and CGE Models

The macroeconometric models usually represent simple regression that fit historical data. These models often incorporate a number of lagged variables and they are not linked to the optimizing behavior of economic actors; or, in other words, they do not have strong microeconomic foundations.

In contrast, the microeconomic models, to which the CGE models belong, are usually derived from explicit optimization problems. These microeconomics models often have a weaker linkage to the time series data than do the macroeconomic models (Parsell et al. (1989)).

Macroeconometric models have an advantage over the CGE models in their ability to apply confidence intervals to the estimated results. However, the CGE models

can provide a richer framework for underlying relationships and also have the ability to offer a powerful tool to evaluate alternative economic policies.

Greenaway et al. (1993) state that "for many large-scale modeling projects, CGE is likely to be the most useful approach given its facility for multi-sectoral modeling – global trade models being a good example"[8] (p. 8).

In this context, it is important to realize that the macroeconometric models and the CGE models are not substitutes for one another; however, they are complements. The solution of the CGE models should be understood as crucial pieces of economic analysis, which, together with other types of analyses, are necessary for policy makers to adopt the best decisions.

Classifications and Examples of CGE Models

The CGE models vary greatly in their classifications. For example, they can be sorted according to policy focus, solution techniques, developed or developing country, single or multi-country models, model size, and many others. (For surveys on CGE models that are applied to mainly developed countries, see Shoven and Whalley (1984 and 1992). For surveys that are applied to LDCs, see Decaluwr and Martens (1988), Dervarajan (1988), and Bandara (1991)). These classifications, not necessarily mutually exclusive, might overlap. In order to give a broad description for some examples of the CGE models, an overview of the first classification, policy focus follows.

Income distribution: The distribution of income was a dominant topic during the 1960s and 1970s because of the existence of poverty along with rapid growth in many of the

[8] For details about the strength and weaknesses of the CGE models, see Greenaway et al. (1993), Chapter 4.

developing countries. Given the complexity of this issue, which incorporates many factors into the analysis, it is best addressed by CGE models. The first empirical CGE model, which focused on this issue, was developed by Adelman and Robinson (1978). They constructed and utilized a large, dynamic CGE model for the South Korean economy to simulate the direct and indirect effects of alternative policies on the distribution of income, given the existing social, political, and economic conditions. Their model is different from Johnsen's (1960) in that it is highly nonlinear and expresses its data in terms of levels. The results support the structuralist view of the policy intervention to reduce inequality.

For similar concerns regarding another developing country, Brazil, Lysy and Taylor (1980) built a multi-sector, multi-level-of-skill general equilibrium model. Investment is set exogenously in real terms; however, in the Korean model above, investment is set exogenously in nominal terms. Adelman and Robinson used several different specifications in their study. Prices are mainly determined by costs, and not by the money market. The main conclusion of the Adelman-Robinson study is that income inequality can be lessened by policies such as well-defined tax and transfer programs, a redistribution of assets toward poor people, and the reduction of structural divergence in the economy. They found that education to develop labor skills would enhance growth of output and income equalization.

The distributional results from the two models mentioned above, about Korea and Brazil, are quite different, which can be attributed to the differences between the two economies and the specifications of the two models. The differences in giving a precise

definition of the term "distribution of income" also might explain part of the divergence between the two models.

Adelman and Robinson (1988) constructed a CGE model that reflects the features of both economies mentioned above. They incorporated different macro specifications in their model, then applied it to the two countries with the same concerns as the above models. The result shows that macro adjustments have a small effect on the size of distribution, but that they strongly affect functional and socioeconomic distributions. The effect of a balance of payments and adjustments in output is found to be important. Recent CGE studies of this issues are of Cameroon by Benjamin (1996) and the U.S. by Hanson and Rose (1997).

Trade policy: The issues of trade policy attract a very large number of CGE studies, especially with regard to single-country, as opposed to multi-country models. During the 1970s, trade strategy for developing countries was an active field. Most of the LDCs believe in the need for a protection strategy on the manufacturing sector, or what is called an "infant industry" argument. Since trade distortions have both welfare costs and dynamic benefits, De Melo and Dervis (1977) built the first CGE model that addressed that topic in a dynamic context. Their goal was to quantify the effects of protection both on employment and on attitudes towards saving by using data from the Turkish economy. The main conclusion of their study is that free trade is preferable when the labor supply to the labor-intensive export sector is very elastic. However, when labor is relatively immobile, the improved welfare under free trade no longer fully works and then protection may dominate free trade.

Dervis et al. (1982) is another example that concentrates on resource allocation and modeling foreign trade. In their study, they address a wide variety of issues in the same context, such as foreign exchange crises, import taxes, export subsidies, etc. Recent CGE models permit more specifications and market rigidities to be addressed. For example, Rutherford and Tarr (1998) investigated the long-term impacts of tariff liberalization in five small countries in South America and East Asia. A two-sector dynamic CGE model was applied to these countries. The first sector produces export and final goods and operates under perfect competition and CRS conditions, whereas the other sector produces intermediate goods and performs under imperfect competition and IRS conditions which reflect the structure of the markets in these countries. The study found a significant welfare for only a 10-percent tariff rate cut. The gain might double with the ability of the country to access international capital markets. Clearly, this result gives support to trade liberalization and financial market reforms. Applegate (1990) for Zambia and Levy (1987) for Mexico are examples of CGE models that investigate the impact of devaluation and trade in these economies.

External shocks and "Dutch Disease":" During the 1970s and especially after the first and second oil shocks in 1973 and 1979, many CGE models concerning external shocks and structural adjustments have been built. The econometric approach failed to analyze these shocks because there was no historical data about the new changes in the market. Most of these CGE studies were applied to the less-developed countries. Bandara (1991) is an example in this category; he built a three-sector CGE model that reflects the basic features of the core model of Dutch Disease economics. The analysis was based on a

hypothetical input-output table. His main goal was to investigate the possible reasons for the Dutch Disease-type effects.

The external oil-price shocks have a different impact in exporting or importing countries: they generate a boom with all its mixed blessings in the first, but produce a recession and other implications in the second.

For an oil-based economy such as Kuwait, Alsabah (1985) constructed an early multi-sector Walrasian general equilibrium model. The concern was to investigate the short- and long-term effects of an expansion in oil revenues on the growth and structure of Kuwait's economy for the period 1979-1989. The results show that the Dutch Disease exists in the short run, so that the aggregate tradable sectors decline and the aggregate non-tradable sectors expand. However, in the long run, the existence of Dutch Disease depends on the policies conducted by policy makers during the boom periods; thus the decline in tradable sectors is not an inevitable consequence of the high inflow of oil revenue.

The same external oil-price shocks have different impacts in an oil-importing country. An example of a CGE model for an oil-importing country is offered by Go (1994), who built a dynamic CGE model to investigate the impact of such shocks and adjustment policies on the Philippine economy. He concludes that domestic tax reform and incentive schemes, along with a tariff reform constitute a perfect combination that can maintain growth and exports without a rapid rise in debt.

Fiscal Policy and Taxation: Fiscal policy and taxation are issues that have been addressed by CGE models for both developed and developing countries. Many of the early CGE studies were concerned about taxation and its distortion effects. These studies

could identify the possibility of a large welfare cost, resulting from taxation. Shoven and Whalley (1972) are pioneers in addressing tax issues in the U.S. by using a CGE approach. They use an artificial commodity, which limits their analysis to one tax at a time. In another study, Shoven and Whalley (1973) develop a procedure, which allows them to do some tax distortion simulations without using an artificial commodity.

With regard to developing countries, Serra-Puche (1984) followed his earlier studies (1979, 1981) in analyzing the tax incidence in Mexico by using a static Walrasian general equilibrium model. The analysis assumes full employment and a perfect mobility of three factors, and simulates the effect of a substitution of a consumption value-added tax regime for a turnover indirect tax regime. The results show that resource allocation moved in favor of the agriculture and foodstuffs sectors and that this also improved the distribution of income.

Recently, economists incorporated human capital into their CGE models, such as Mahi (1996) for Indonesia and Lord and Raugazas (1998) for the U.S. Their goals are to simulate the impact of the presence of endogenous human capital investment on the redistribution component of the income tax structure.

Development Strategy and Structural Change: CGE models are popular in dealing with alternative development strategies and the structural change in an economy. As an example of these studies, Kubo et al. (1984) built a dynamic CGE as well as Input-Output models for the South Korean economy. The goal was to evaluate alternative inward and outward development strategies. This study concluded that only the multi-sector model could capture the direct and indirect linkages. The two models are in broad agreement, even though there are significant differences in the mechanisms. With the same concern

regarding import-substitution and export led-growth strategies, de Melo and Robinson (1990) focus on export and import externalities. They identify the linkages and mechanisms through which trade strategy promotes growth, and calibrate their CGE model to a Korean-like economy; the model allows for one possible explanation for total factor productivity (TFP) growth. The results support government intervention to coordinate private sector activities. In another study, Kilkenny and Otto (1994) analyze rural structural change and development policy in the U.S. at the regional level. A new way to create a CGE model to account for such changes was examined. They gave econometric studies an important purpose for the use of CGE models, not just for parameter estimation, but also regarding the degree of interaction between markets and other the structural features of the markets. At the same time they called for theorists and econometicians to be interested in CGE models as a way to simulate equilibrium theories tested under partial-equilibrium assumptions.

Economic Growth: The traditional growth-accounting approach has been criticized for excluding resource misallocation from its analysis, for not accounting for the externality of human and social capital, and for being away from the application use of the structure of an economy and its alternative policy evaluation.

To account for the externality of human capital through export of the manufacturing sector, with a reflection of the structure of the economy, Rodrigo and Thorbecke (1997) developed a CGE model for Indonesia. In their model, the total factor for productivity growth is determined endogenously. They could then analyze the effect of externalities and the result of that effect on growth performance.

In a comparison study between the approaches of growth accounting and of applied general equilibrium approaches, Hamilton et al. (1988) examine the growth performance of India, the U.S., and the Soviet Union by using the two approaches. They take into account the influence of institutional arrangements on growth, illustrating that the earlier approach excluded the resource-misallocation effect because it was based on a one-sector model, which leads to dramatically different policy implications between the two approaches. For this reason they argue not only that recently developed applied general equilibrium techniques provide a tractable multi-sectoral framework as an alternative approach for analyzing growth performance, but that perspectives on the determination of growth can be quite different (Hamilton et al. (1988), p. 281).

Diao et al. (1996) incorporate R & D endogenous growth into a dynamic CGE model that fit East Asian economies, then simulate alternative policies. Their results show that liberalizing the agriculture sector will only increase its relative price. However, if only non-agriculture sectors are liberalized, or if all taxes are eliminated from the economy, the opposite result is obtained. They also conclude that welfare gain from interventions to correct market failures might exceed trade reforms. Finally they attempt to test the effect of R & D as a source of growth.

Migration and accumulation of human capital: Many factors affect the decisions of migration; social, political, and economic factors are recognized as the major factors for migration. Immigration has its direct impact in the labor market and economic growth, and can be considered a reallocation of resources, which can create winners and losers. A dynamic general equilibrium model with two-period overlapping generations and heterogeneous agents was used by Haque and Kim (1995) to test the impact of migration

on income and economic growth. Their model was based on a two-country analysis, where growth is driven by economic agents accumulating human capital. They show how the differential in government policies, such as taxes and education subsidies, can lead to talent migration and hence generate a permanent reduction of per capita growth in the labor-exporting country. At the same time, it can increase the growth in the labor-importing country. In the long run, the migration of human capital can lead to differences between countries in both levels and growths of per capita incomes. However, such theoretical analysis does not satisfy the needs of policy makers and the many economists interested in quantitative analysis. The CGE models are a more appropriate approach for such an analysis, because they account for the indirect, as well as the direct, effect of labor migration on the economy.

For developed regions such as the U. S., the European Community (EC), EFTA, small Eastern European economies and the former Soviet Union, Weyerbrock (1995) constructed a multi-region multi-sector CGE model. His main concern was on analyzing the impact of the immigration of workers from east Europe and the former Soviet Union on labor market, macroeconomic and fiscal variables of the EC. In the model, the future migration flow is largely determined by immigration restrictions, and the (urban) wages in most industrial sectors is considered rigid because of a high degree of unionization. The impact of immigration is found to depend on the labor-importing country's wage regime. If the average urban wage in the receiving countries (EC) is fixed, then immigration is hardly affects macroeconomic variables such as real GDP. Over time the growth in capital stock eases the adjustment problems on the labor market. However, if

the average urban wage are flexible, employment will be higher and then that leads to an expansions in macroeconomic variables.

On the other hand, for an oil-developing country like Saudi Arabia, Tawi (1989) modified the CGE model developed by Dervis et al. (1982) to test the impact on expatriate labor on several economic variables. In his model, the supply of expatriate labor is assumed to be elastic; however, the total labor supply is considered fixed. He found a significant impact of expatriate labor on sectoral output, consumption, wages, prices, and the balance of payments. A change in domestic demands also an important factor in determining the net impact on the above variables.

Unlike the studies mentioned above, this study account for endogenous domestic human capital in a CGE models context. It is also a dynamic study so that the direct and indirect impacts of government policies regarding migration, investment in indigenous human capital and a reduction in the retirement rate on the economy can be traced overtime.

A summary of the CGE models reviewed here is given in Table 11.

Table 11

A Summary of CGE Models According to Policy Focus

No	Author	Year	Study	Country
1.	Adelman and Robinson	1978	The effect of alternative policies on distribution of income	South Korea
2.	Adelman and Robinson	1988	The effect of alternative policies on income distribution	Brazil and South Korea
3.	Alsabah	1985	Dutch Disease impact	Kuwait
4.	Applegate	1990	The impact of devaluation and import substitution	Zambia
5.	Bandara	1991	Dutch Disease impact	(hypothetical I-O table)
6.	De Melo and Dervis	1977	The trade protection impact on employment and saving behavior	Turkey
7.	Dervis et al.	1982	The impact of alternative trade strategies	Turkey
8.	Diao et al.	1996	The impact of alternative policies on growth performance with accounting for R&D	East Asian countries
9.	Hamilton et al.	1988	Growth performance	India, the U.S. and the Soviet Union

10.	Haque and Kim	1995	The impact of migration on income and economic growth	(GE)
11.	Kilkenny and Otto	1994	Rural structural change	The U.S.
12.	Kubo et al.	1984	An evaluation of alternative inward and outward development strategies	South Korea
13.	Lysy and Taylor	1980	The effect of alternative policies on income distribution	Brazil
14.	Mahi	1996	The impact of existence of endogenous human capital investment on income tax structure	Indonesia
15.	Rodrigo and Thorbecke	1997	The externalities effect of human capital on growth performance	Indonesia
16.	Rutherford and Tarr	1998	Simulation the effect of liberalization	Five countries from South America and East Asia
17.	Serra-Puche	1984	Taxation and the distribution of income	Mexico
18.	Shoven and Whalley	1975	A Comparison between general and partial equilibrium models in taxation context	United Kingdom
19.	Tawi	1989	The impact of expatriate workers on a major macroeconomic variables	Saudi Arabia
20.	Weyerbrock	1995	The impact of immigration of workers from East Europe and the former Soviet Union	European Community

CHAPTER IV

THE MODEL

Introduction

A description of the structure of static (within-period) and inter-temporal dynamic CGE models for Kuwait will be given in this chapter, in addition to the data used and the calibration of the model. The goal of this chapter is to develop a model that will be used to investigate the role of expatriate labor and simulate the short- and medium-term economic impact of investment in different types of education in the Kuwait economy, in addition to estimating the impact of a change in social security laws regarding the retirement rate.

The model belongs to the group of CGE models for a small open economy--where the prices are flexible to clear all markets simultaneously--of the type presented in Dervis et al. (1982) and Shoven and Whalley (1992). Some modifications have been applied to the former model to reflect the structure of the Kuwait economy and also to help achieve the objectives of this study. For example, an endogenous labor supply is incorporated into the model by using data from the educational system in Kuwait, which most of the CGE studies assume to be exogenous or fixed.

The model is nonlinear with ten sectors and four primary factors of production: skilled, semi-skilled, and unskilled labor, and capital. The sectoral production process is

described by a Cobb-Douglas (CD) production function with constant returns to scale and a given rate of technological progress.

The behavior of three different economic actors has been modeled: households, firms, and the government. The model operates by simulating these behaviors in both product and factor markets, and by assuming profit maximization for producers and utility maximization for consumers.

The small country assumption is followed for both import and export sides so that international terms of trade are fixed. Imports in this study are treated as noncompetitive to domestically produced goods. The outcome of the interaction between different actors would be a set of prices that clear all markets simultaneously.

Production and employment will be presented in the following section; then income determination and the demand side will be discussed. Foreign trade, balance of payment, and exchange rate sections will follow. Presenting the product market equilibrium will close the static model, after which the dynamic linkages will be discussed. Finally, data and the calibration of the model will be described.

The Structure of the Static CGE Model

Production and Employment

The economy consists of ten sectors: agriculture, crude oil, petroleum refineries, electricity and water, manufacturing, construction, trade, transportation, finance, and services. Each sector in the economy is assumed to produce a single homogenous output, X_i. In the description of the components of the model, the i and j are sector subscripts and the s represents skill types of labor.

Three types of labor (L_{1t}, L_{2t}, and L_{3t}) and capital (K_{it}) are used in the production process as a primary factors. Types of labor represented are skilled, semi-skilled, and unskilled, respectively. Each sector has specific fixed ratio of capital that is different in its structure from other sectors. This allows for aggregation within sectors only, which will result in (n) types of capital. Full employment is a reasonable assumption in a labor-short economy such as Kuwait. The sectoral capital stock represents an aggregation of various kinds of capital such as machines, buildings, and other equipment and capital goods. Also, each type of labor is assumed to be sector-specific to reflect the rigidity in the economy. This means there is no labor or capital mobility between sectors within the same period, resulting in (s.n) wage rates (W_{ist}) and ten prices of capital (U_{it}). However, over time, capital is mobile across sectors according to profitability.

The production of output in constant (1995) prices is described by a multi-factor Cobb-Douglas function[5] of the four primary inputs mentioned above for each sector. Production technology is specified to exhibit constant returns to scale.

$$X_{it} = (1+\lambda_i)^{p_t}\ \Omega_i L_{1it}^{\alpha 1} L_{2it}^{\alpha 2} L_{3it}^{\alpha 3} K_{it}^{(1-\alpha 1-\alpha 2-\alpha 3)} \qquad \begin{matrix} i = 1, \ldots \text{n} \\ t = 1, \ldots T \end{matrix} \qquad (1)$$

where

X_{it} = sector output

Ω_i = shift production parameter

L_{sit} = sectoral labor inputs for each type of skill

K_{it} = an aggregation of sectoral capital inputs

α_1, α_2 and α_3 = output elasticities with respect to skilled, semi-skilled and unskilled labor inputs, respectively

[5] The CD function is a special case of the Constant Elasticity of Substitution (CES) function when the elasticity of substitution approaches one.

λ_i = rate of technical progress

p_t = time period, equal zero for the base year

The formulation assumes a unitary elasticity of substitution, which allows for a smooth neoclassical substitution between labor and capital and also between each type of skill of labor to be assumed here. The parameters in the sectoral production functions are derived from factor-share data in the base-year period, 1995.

Producers' behavior can be described by profit maximization with a technology that exhibits constant returns to scale. Their demand for intermediate goods is assumed to be a linear function of output; fixed coefficients of intermediate inputs, *aij*. Unlike primary factors, the demands for intermediate goods are not as price responsive.

By including government to the model, the net sectoral prices or per unit value added can be given by the following equation.

$$PN_{it} = PD_{it}(1 - tau_i) - \sum_j PD_{jt}\, a_{ij} \qquad \begin{matrix} i = 1, \ldots \text{n} \\ t = 1, \ldots T \end{matrix} \qquad (2)$$

where

PD_{it} = domestic prices

tau_i = net indirect tax rates

a_{ij} = fixed input-output coefficients

With the competition condition in both goods and factor markets, the first order conditions for profit maximization required that each type of labor be employed up to the point where the nominal wages (W_{ist}) equal marginal revenue products (MRP_{Lt}), which reflect the following conditions.[6]

---

[6] Demand for each type of labor can be derived from the following condition: $MRP_{Ls} \equiv PN_i \frac{\partial X_i}{\partial L_{is}} = W_s$.

$$W_{1it} = PN_{it}\,\alpha_{1i}\left(\frac{X_{it}}{L_{1it}}\right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (3)$$

$$W_{2it} = PN_{it}\,\alpha_{2\,it}\left(\frac{X_{it}}{L_{2it}}\right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (4)$$

$$W_{3it} = PN_{it}\,\alpha_{3\,i}\left(\frac{X_{it}}{L_{3it}}\right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (5)$$

where

W_{1it}, W_{2it} & W_{3it} = the sectoral nominal wages for each type of labor

PN_{it} = sectoral net prices

According to the conditions in equations (3), (4), and (5), the demand for labor will depend on nominal wage, nets prices, and sectoral output.

The supply of labor is usually assumed to be exogenous; however, in this study the labor supply is endogenous. A set of equations is used to estimate the indigenous labor supply for each type of skill, according to educational levels.

Total labor supply for each skill category (NT_{st}) is composed of indigenous labor force (NKT_{st}) and a foreign labor force (NFT_{st}).

$$NT_{st} = NKT_{st} + NFT_{st} \qquad s = 1, 2, 3 \quad t = 1, \ldots T \qquad (6)$$

where the foreign labor supply (NFT_{st}) is treated as exogenous. It supplements the indigenous labor force of each type of skill to satisfy the excess demand for labor and restore full employment. The access of such types of labor to the domestic labor market is supposed to be governed by migration policy. A restricted migration policy on foreign labor inflow will reduce the participation rate of the expatriate labor force, which means a higher demand for indigenous labor, whereas an unrestricted policy would first drive the

demand for indigenous labor down, and then the wages down. This specification can serve the assessment of the impact of a change in the participation of expatriate labor in the total labor force.

The indigenous labor supply for each type of skill is equal to the past stock of labor force augmented by the output from the educational system of each type of skill after accounting for retirements, death, and for graduates who continue their studies. A Not Elsewhere Classified (NEC_{st}) category of indigenous labor force is added to the basic equations below to account for factors such as those who are out of labor force, unemployed, or those who are promoted to a higher level of skilled labor.

$$NKT_{st} = LNK_{st} + EDUG_{st} - R_{st} - DI_{st} - S_{st} + NEC_{st} \qquad \begin{matrix} s = 1, 2, 3 \\ t = 1, \ldots T \end{matrix} \qquad (7)$$

where

LNK_{st} = the stock of last year's labor force for each skill category

$EDUG_{st}$ = the output of the educational system for each skill category

R_{st} = dropouts from the labor force because of retirement for each skill category

DI_{st} = dropouts from the labor force because of death and illness for each skill category

S_{st} = graduates from the educational system who continue their studies for each skill category

NEC_{st} = not elsewhere classified labor which represents inactive labor force for each skill category in addition to unemployment and job promotions.

R_{st}, DI_{st}, and NEC_{st} of each type of skill are treated as a proportion of the equivalent total indigenous labor force (NKT_{st}). However, S_{st} of each type of labor is

defined as a proportion of the output of the educational system ($EDUG_{st}$)[7], which is estimated by the following regressions:

$$KUG_t = \beta_0 + \beta_1 KUG_{t-1} + \beta_2 KUEXP_t \qquad t = 1, \ldots T \qquad (8)$$

$$PAASG_t = \delta_0 + \delta_1 PAASG_{t-1} + \delta_2 PAASEXP_t \qquad t = 1, \ldots T \qquad (9)$$

$$HSG_t = \theta_0 + \theta_1 KPOP_{t-1} + \theta_2 EDUEXP_t \qquad t = 1, \ldots T \qquad (10)$$

The educational system in Kuwait produces three types of labor: skilled, semi-skilled, and unskilled. Equation (8) represents the output of skilled indigenous labor from the educational system. The Kuwait University graduates (KUG_t) are considered skilled labor. The KUG_t is assumed to be a function of lagged value (KUG_{t-1}) and government expenditures on Kuwait University ($KUEXP_t$). The graduates from the four colleges of *PAAET* (*PAASG*) are treated as semi-skilled labor and estimated (in equation (9)) by using the lagged value ($PAASG_{t-1}$) and government expenditures on such kinds of education as explanatory variables. This study does not intend to account for short training that is performed by *PAAET* and Kuwait University or others. Because of the difficulties in obtaining data about students who drop out of school before high school graduation, these students are considered as a residual. Thus only high school graduates (*HSG*) are estimated by using the lag of the Kuwaiti population ($KPOP_{t-1}$) and government expenditures on general education ($EDUEXP_t$) as explanatory variables, given by equation (10).

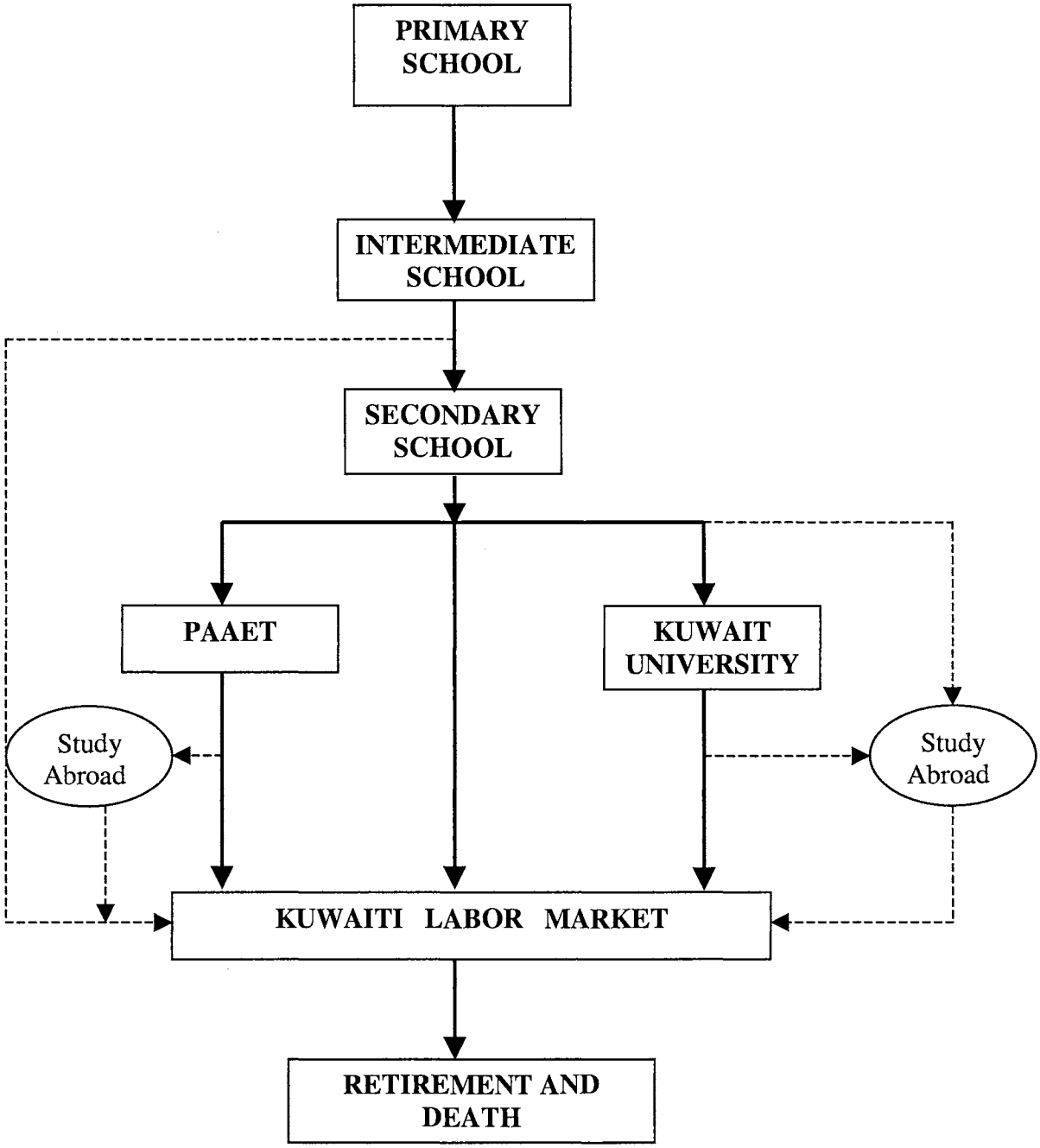
Figure 1 shows the relationships between the educational system and the labor market in Kuwait. The solid lines in the figure represent the main flow of students, while the dashed lines represent only a small proportion of that stream.

[7] For some details about the educational system in Kuwait, see Chapter II.

It is noteworthy here to say that for every year, the output of the educational system of the three skill levels either goes to the labor market directly to participate in the total labor force or continues studies domestically or abroad (S_{st}). Those graduates who continue their studies are treated as a proportion of the output of the educational system of each skill category. However, the output of high school students who study abroad is not accounted for because of the difficulties in accessing to such data.

Figure 1

The Kuwaiti Educational System and Labor Market Framework



Total labor and the expatriate labor supply for each type of skill that generates from equation (6) are distributed across sectors according to the base-year fixed proportions in each time period as shown in the following equations.

$$NF_{sit} = fe_{si} NFT_{st} \qquad i=1, \ldots n \quad t = 1, \ldots T \qquad (11)$$

$$N_{sit} = f_{si} NT_{st} \qquad i=1, \ldots n \quad t = 1, \ldots T \qquad (12)$$

where fe_{si} and f_{si} are distributional parameters.

By assuming full employment, the demand for labor (L_{sit}) generated from equations (3)-(5) will meet with the supply of labor (N_{sit}) generated from equation (12) so that the wage rates for each type of labor will be determined.

$$\sum_{i}^{n} L_{1it} = \sum_{i}^{n} N_{1it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (13)$$

$$\sum_{i}^{n} L_{2it} = \sum_{i}^{n} N_{2it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (14)$$

$$\sum_{i}^{n} L_{3it} = \sum_{i}^{n} N_{3it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (15)$$

A higher supply of labor will put downward pressure on the wage rate, whereas higher demand for labor creates upward pressure. The wage rate flexibility ensures the labor market clearing in each sector so that the supply of labor equals the demand for labor.

Equations (13)-(15) represent the excess demand for labor which will be derived to be zero, full employment, by assuming a competitive market and wage flexibility. This means that labor markets will be cleared so that the demand for labor equals the

supply for labor in each skill category. The resulting equilibrium wages will depend on a set of prices, including the price of capital.

Income Determination and Demand for Commodities

The production of all sectors is consumed by households, the government, and firms, which are the sources of demands. The first two categories consume consumption goods, whereas the last category consumes intermediate and capital goods. Thus, we need to determine the incomes of each of those categories as well as the functional distribution of income, before we get to the demand side.

Wage Income (Y_{wt}) : As a compensation for labor services, households receive an amount of income which is determined by summing up the wage bills for all types of labor and across sectors. Note that there is no income tax on individuals in Kuwait.

$$Y_{wt} = \sum_{i=1}^{n} \sum_{s} W_{st} L_{ist} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (16)$$

Capital Income (Y_{kt}): The capital income is equal to the aggregate value added less wage income and then subtracting the amount of tax on capital income. Because the government owns all the oil capital, the value added from the crude oil sector including—depreciation--is subtracted from capital income and added to government income.

$$Y_{kt} = \left(\sum_{i} PN_{it} X_{it} - Y_{wt} - PN_{2t} X_{it} + Y_{w2t} \right)(1-t) \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (17)$$

where

$PN_{2t}X_{2t}$ = value added for the crude oil sector,

Y_{w2t} = wage income for the crude oil sector

Government Income (Y_{gt}): The government receives income from direct and indirect taxes and also from the crude oil sector, as mentioned above.

$$Y_{gt} = Y_{kt}\frac{t}{(1-t)} + \sum_{i}^{n} tau_i \cdot PD_{it} \cdot X_{it} + PN_{2t} \cdot X_{2t} - Y_{w2t} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (18)$$

where

tau_i = indirect tax rates

PD_{it} = domestic prices

Gross Domestic Product (GDP_t): Gross domestic product, at market prices, is defined as the sum of total wage, capital, and government incomes as defined above.

$$GDP_t = Y_{wt} + Y_{kt} + Y_{gt} \qquad t = 1, \ldots T \qquad (19)$$

Total Domestic Saving (TDS_t): As in the neoclassical view, total saving is determined by applying saving rates to different income categories. Each of the categories receiving income divides its income so that some is in the portion in which it consumes and the other in which it saves. Total domestic saving in the economy is the sum of household, government, and capital savings. It is assumed that households and firms have the same fixed saving rate; private saving rate.

$$TDS_t = S_p(Y_{wt} + Y_{kt}) + S_g(Y_{gt}) \qquad t = 1, \ldots T \qquad (20)$$

where

S_p = private saving rate

S_g = government saving rate

The final demand equations of the various economic actors are derived from a representative consumer that maximizes utility subject to budget constraint.[8] Thus, the only requirement on the demand functions is that they satisfy the budget constraint of each representative consumer.

[8] Properties of Cobb-Douglas functions are summarized in Table 4.8 in Shoyen and Whalley (1992).

Total private Consumption (TC_{pt}): Households and producers use part of their income to purchase products from different sectors. Their consumption is equal to their marginal propensity to consume multiplied by disposable private income, which is given by equation (21). However, the sectoral private consumption, in real terms, is defined as total current private consumption divided by domestic prices, then multiplied by a fixed distribution ratio (fcp_i).

$$TC_{pt} = (1 - S_p)(Y_{wt} + Y_{kt}) \qquad t = 1, \ldots T \qquad (21)$$

$$C_{pit} = fcp_i \left(\frac{TC_{pt}}{PD_{it}} \right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (22)$$

where fcp_i is the distributional share of private consumption.

Total Government Consumption (TC_{gt}): Similar to the private consumption demand, the total government consumption demand is equal to the government sector's marginal propensity to consume multiplied by government income. Also, the sectoral government consumption, in real terms, is defined as total government consumption in current prices divided by domestic prices, then multiplied by a fixed distribution ratio (fcg_i).

$$TC_{gt} = (1 - S_g)(Y_{gt}) \qquad t = 1, \ldots T \qquad (23)$$

$$C_{git} = fcg_i \left(\frac{TC_{gt}}{PD_{it}} \right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (24)$$

where fcg_i is the distributional share of government consumption.

Total consumption demand in the economy is the aggregation of private and government consumption demands.

$$\sum_i C_{it} = \sum_i C_{pit} + \sum_i C_{git} \qquad i = 1, \ldots, n \qquad (25)$$

$$t = 1, \ldots T$$

The demand functions in equation (25) represent a homogenous behavior of consumers in which they derived from maximization behavior of their utility of consumption. These consumption demands are homogenous of degree zero in prices and incomes, which means that doubling prices and incomes will not change the consumption behavior of consumers. The sectoral consumption functions can be written as a function of commodity prices.

Investment Demand (Z_{it}): In this model capital is differentiated not only by sector of origin, but also by sector of destination to which imply that sectors are different in their rate of capital gain/loss. In this section investment demand by sector of origin (Z_{it}) is defined as a capital composition matrix multiplied by the investment demand of the sector of destination in real terms.[9] In other words, investment by sector of destination can be translated to investment by sector of origin by using the shares in the capital composition matrix.

$$Z_{it} = \sum_j S_{ij}\, dK_{jt} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (26)$$

where

S_{ij} = capital composition matrix

dK_{it} = investment demand by sector of destination

Since the structure of capital is fixed for each sector, the price of capital (U_i) is assumed to be fixed ratio (S_{ji}) of domestic prices.

$$U_{it} = \sum_j S_{ji} Pd_j \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (27)$$

[9] Investment demand by sector of destination is defined in equation (41).

Foreign Trade

Kuwait is an open economy, where foreign trade plays a vital role in its development. To incorporate foreign trade into the model, we need to reflect the determination of import and export in addition to the balance of payment and the exchange rate system. Also, we need to account for import tariffs and export subsidies. There are many ways that imports can be handled. One approach is to treat imported and domestically produced goods as competitive, or perfect substitutes, which means that they are the same in all uses. That implies that foreign and domestic goods have the same price and also that the good is either imported or exported, but never both. However, the empirical evidence supports the existence of two-way trade even at disaggregated levels and also for developed and developing countries (Grubel and Lloyd, 1975.)

The second approach treats imports and domestic goods as noncompetitive, or complements, so that they have different uses. According to this approach, prices in imports and domestic goods are different. It is expected that the effect of trade policies in the domestic economy will be less than the former approach. As a compromise approach, Dervis et al. (1982) and many other recent CGE models follow Armington (1969) who uses a CES function to create a composite commodity of both imports and domestic goods.

In this study and for a less-developed economy endowed with oil such as Kuwait, imported goods are assumed to be noncompetitive with domestically produced goods. The selection of this approach is dictated by the actual domestic production in Kuwait economy and also the unavailability of reliable estimates for the elasticity of substitution between imported goods and domestically produced goods in Kuwait or a similarly

structured economy required by this approach. The small-country assumption holds in the sense that international terms of trade are fixed. Accordingly, the country faces an infinitely elastic foreign supply of imports at a given world import price. Also, it faces an infinitely elastic foreign demand at a given world export price.

Sectoral Import (M_{it}): The sectoral import demand is treated as proportional to sectoral domestic output. The factor of proportionality depends on the base-year share of sectoral imports in sectoral total output supply (μ_i).

$$M_{it} = (\mu_i / (1 - \mu_i)) X_{it} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (28)$$

Total import is simply the sum of sectoral imports:

$$TM_t = \sum_i M_{it} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (29)$$

The domestic price of imports (PM_{it}) is represented as follows:

$$PM_{it} = PW_{it}(1 + t_{ri}) ER_t \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (30)$$

where

PW_{it} = fixed world price of imported goods in U.S. $

t_{ri} = sectoral tariff rates

ER_t = exchange rate (KD/$)

Equation (30) represents the small-country assumption, on the supply side, so that the domestic price of imports is equal to the world price of imports multiplied by one, plus the tariff rate, translated to domestic prices via the exchange rate. According to this specification, the exchange rate does not have a direct effect on imports.

As mentioned above, the small-country assumption is held for Kuwait so that it is a price taker, and the world price of imports is determined exogenously.

On the export side, the small country assumption implies that the change in the country's price of export can affect the country's share in the world market, but it has no influence on the world average price. In this model both oil and non-oil exports are determined exogenously ($\overline{E_t}$).

$$E_{it} = \overline{E_{it}} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (31)$$

The price of exports in foreign currency (PWE_{it}) is represented in the following equation:

$$PWE_{it} = \frac{PD_{it}}{((1+te)ER_t)} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (32)$$

where

PD_{it} = domestic prices

te_i = export subsidy

ER_t = exchange rate (KD/$)

Similar to equation (30), equation (32) translates the small-country assumption, but on the demand side. It shows that any change in domestic production costs, export subsidies, or exchange rates will be reflected directly to a change in price of exports in foreign currency.

Balance of Payment and Exchange Rate

The balance of payment in foreign exchange is given by the following equation:

$$SCT_t = -(\sum_j PW_{it} M_{it} - \sum_j PWE_{it} E_{it}) - rm\left(\sum_j \sum_s W_{st} NFT_{st}\right) / ER_t + NPEY_t / ER_t - (OTROW / Pa_t) / ER_t + NPEY_t / ER_t \qquad i = 1, \ldots, n \qquad (33)$$

$$t = 1, \ldots T$$

where

SCT_t = surplus in the current transactions (in millions of US $)

rm = the rate at which foreign labor remits part of its income to the rest of the world

$OTROW$ = other net transfer payments to the rest of the world

$NPEY_t$ = net property and entrepreneurial income

Pa_t = GDP deflator

The model treats surplus in the current transactions (SCT_t), or foreign capital inflows, as equal to the current account balance (the difference between value of imports and value of exports) adjusted for foreign labor remittances and other net transfers to the rest of the world, and also for net property and entrepreneurial income. For the dynamic part purposes, the $NPEY_t$ is replaced by a time-trend forecast. Remittances have been incorporated through equation (33) to reflect the influence of expatriate labor on the balance of payment in the economy. Since the country cannot control both the exchange rate and the capital inflow, foreign capital inflow is determined endogenously, given a fixed exchange rate and other exogenous components in the above equation.

A fixed exchange rate regime and flexible capital-inflow closure is used here to reflect the actual Kuwait economic system. The monetary authority cannot control both the exchange rate and the foreign capital inflow, since controlling one of them causes the other to adjust to clear the foreign market.

The monetary authority in Kuwait fixed the exchange rate of the Kuwaiti Dinar (*KD*) by using the exchange rate of the major currencies, basket of currencies. The major

currencies are assumed to be the British pound, the Deutsche Mark, and the Japanese yen, whereas the U.S. dollar is used as the denominator for all of the exchange rates.

Accordingly, the Kuwaiti exchange rate (ER_t = *KD/$*) will be given by the following equation:

$$ER_t = \beta_0 + \beta_1 UK_t + \beta_2 GR_t + \beta_3 JP_t \qquad t = 1, \ldots T \qquad (34)$$

where

UK_t = British pound (£/$)

GR_t = Deutsche Mark (DM/$)

JP_t = Japanese yen (¥/$)

The coefficients in equation (34) represent the estimated weights that the monetary authority in Kuwait gives to major currencies of countries with which Kuwait has trade relations.

Supply-Demand Balance

The total demand for domestically produced goods (X_{it}^{d}) is simply the aggregation of its components: consumption, investment in addition to change in stocks, and export demand.

$$X_{it}^{d} = C_{it} + Z_{it} + E_{it} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (35)$$

Since each of the components of the total demand depend on the price vector, the total demand can be expressed in terms of these prices.

$$X_{it}^{d} = f(PD_1, \ldots, PD_n) \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (36)$$

The supply side X_i^s is the aggregation of domestically produced goods that are not exported in addition to imports. It can also be expressed in terms of prices.

$$X_{it}^{s} = f(PD_1, \ldots, PD_n) \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (37)$$

Then the excess demand (ED_{it}) functions are the difference between demand and supply. The solution of the model can be reached only when all markets are cleared, where the excess demands equal zero. That can be given in the following equation.

$$ED_{it} = X_{it}^{d} - X_{it}^{s} = 0 \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (38)$$

Since both the demand and supply are expressed in terms of prices, then excess demand functions also depend on the price vector.

$$ED_{it} = f(PD_i, \ldots, PD_n) \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (39)$$

Thus, the whole system is now summarized in these (n) excess demand equations and (n) variables, PD_{it}. There are two important characteristics for the excess demand functions in equation (39). First, they are homogenous with degree zero in all prices, so that doubling all prices will not affect the solution because the relative prices will be unchanged. Second, by Walras Law, excess demand equations are not independent. For example, if ($n - 1$) excess demands are zero, the n'th excess demand will be zero also. That implies that the unique solution can only be determined by relative prices. Thus, some sort of price normalization is required here to close the system. The nominal wage rate or domestic price could serve as a numéraire; however, the average price has been chosen as a numéraire as in the following equation.

$$\sum_{i} \Pi_i \, Pd_{it} = Pa_t \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (40)$$

where

Π_i = weights of the price index

Pa_t = overall price level

The normalization rule acts implicitly as an introduction of money so that we could avoid introducing the financial sector. The overall price level is adjusted between periods only to account for inflation. By introducing price normalization (equation (40)), only the relative prices, not the price level, matter. The system now can be solved for the unique solution of prices because now we have n equations and $n - 1$ unknown.

Gauss program[10] as a mathematical algorithm was used here to solve the system of non-linear equations. The algorithm reaches the solution when the excess demands become sufficiently close to zero.

Dynamic Linkages

The dynamic model consists of several periods connected to the static model by using inter-temporal linkages. To run the model over time, we need to specify the exogenous variables for all the years in which the model is to be solved. The main interest is not to forecast the endogenous variables, but to see how the economy responds to policy changes. A simple forecast is used to estimate exogenous variables such as expatriate labor in each type of skill, expenditures in education, population, and others.

In the static part of the model, the sectoral investment shares are treated as given or exogenous. However, in this part, the structure of investment by the sector of destination will be updated. The simple formulation that was used by Dervis et al. (1982) to model sectoral investment allocation will be followed here.

[10] The model here was implemented by utilizing the Gauss software for Windows NT/95 Version 3.2.38, and calibrated to Kuwait economic data for 1995.

According to the neoclassical view, total investment is equal to total savings in the economy. Investment by sector of destination, in real terms (dK_{it}), is defined as the total savings multiplied by the sectoral investment shares (H_{it}), then divided by the price of capital (U_{it}). The total saving in this equation is the sum of total domestic savings (TDS_t), foreign trade balance, and the change in stocks (CHS_i). Note that because we define capital here by sector of destination the structure of capital is adjusted between periods according to profitability.

$$dK_{it} = \frac{H_{it}\left(TDS_t + (\sum_i Pm_{it} M_{it} - \sum_i PWE_{it}\, E_{it}\, ER_t) + \sum_i CHS_i \right)}{U_i} \quad i = 1, \ldots, n \quad (41)$$

Sectoral profits, after tax, are equal to the total value added for factors of production $(PN_{it} \cdot X_{it})$ multiplied by the output elasticity of capital $(1-\alpha_1-\alpha_2-\alpha_3)$, after accounting for taxes.

$$RK_{it} = (1-\alpha_{1i}-\alpha_{2i}-\alpha_{3i}) PN_{it}\, X_{it}(1-t) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (42)$$

Total profit is merely the sum of sectoral profits.

$$RK_t = \sum_i RK_{it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (43)$$

Nominal sectoral profit rates (r_i) are defined as returns to capital valued in current prices, plus capital gains.

$$r_{it} = \left(\frac{RK_{it}}{U_{it} \cdot K_{it}} \right) + \left(\frac{U_{it} - U_{it-1}}{U_{it-1}} \right) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (44)$$

where

U_{it-1} = sectoral price of capital in previous period

The sectoral shares in aggregate profit (SP_{it}) are simply the sectoral profits (RK_{it}) divided by total profit (RK_t) and given as the following.

$$SP_{it} = \frac{RK_{it}}{RK_t} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (45)$$

The average nominal profit rate (AR_t) is just the sectoral share in aggregate profit (SP_{it}) multiplied by the nominal sectoral profit rates (r_{it}).

$$AR_t = SP_{it} \cdot r_{it} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (46)$$

Current profit rates, profit share, and average profit in equations (44)-(46), respectively, determine the sectoral share of the investment for the next period (H_{t+1}), according to the following equation.

$$H_{t+1} = SP_{it} + SP_{it} \cdot \frac{(R_{it} - AR_t)}{AR_t} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (47)$$

The first term in equation (47) is the sectoral share in total profits (SP_{it}), while the second term is the sectoral share of the profit multiplied by the relative profit rate. In this specification and at the beginning of each period, the sector with a higher profit than the average of the whole economy will receive a larger share of investment funds than its share in aggregate profit (SP_{it}), and vice versa.

The sectoral capital stock for the following time period (K_{it+1}) is defined as current capital stock (K_{oit}) plus investment by sector of destination (dK_{it}) after accounting for depreciation.

$$K_{it+1} = K_{oit} + dK_{it} - d_i \cdot K_{it} \qquad \begin{matrix} i = 1, \ldots, n \\ t = 1, \ldots T \end{matrix} \qquad (48)$$

where

K_{oit} = initial sectoral capital

d_i = depreciation rates

By completing the model, a summary of the model's equations, and a list of endogenous and exogenous variables in addition to parameters, are given in Appendix A.

Database and Model Calibration

The database for the model reflects the structure of the Kuwaiti economy for the year 1995. The model calibration involves fitting the model to the benchmark data set. The data requirements for the model calibration are mostly the Input-Output Table (1995), including value-added rows and final demand columns, national accounts, and labor force data for the three types of skills in addition to capital stock estimates. Various sources of data were used to estimate the output of the educational system in Kuwait. The reference-run database is given in the Appendix B.

The CGE model assumes that the initial conditions (base-run data) in all markets of the economy are in equilibrium. The coefficients and parameters of the model are either estimated or calibrated for base-year data.

A calibration of data is required to ensure that the model will produce the equilibrium solution values that match the benchmark date, 1995. As in the static model, the assumption of equilibrium is also held for the dynamic part. The model is assumed to solve for equilibrium points (paths) over time. The model was calibrated, equation by equation, so that it can reproduce the benchmark data, given the exogenous variables and parameters. The validity of the model can be tested by replicating the benchmark data and approximating real world behavior. Thus, the objectives of the study can be achieved by simulating some alternative policies.

The next step is that, given exogenous variables and parameters, the model equations are solved simultaneously for endogenous variables. To simulate the impact of a certain policy, parameters or exogenous values can be altered, and then the results can be compared with equivalent benchmark values.

The production functions of each sector have six parameters--three labor shares parameters, a capital share parameter and two shift parameters--representing productivity and technological progress. Under the perfect competition assumption, the elasticity of output with respect to each type of labor (skilled, semi-skilled, and unskilled) can be obtained from income shares. By assuming Constant Returns to Scale (CRS) of the Cobb-Douglas production function, the capital share parameter is merely a residual of the total income shares. Once the income share parameters are solved, the productivity parameter can be calculated, whereas the technology progress parameter is assumed to be fixed at value of 1 percent. Appendix B shows the elasticities of output with respect to capital and each type of labor.

The Input-Output Table (1995) provides labor income for each sector. The PACI is considered an excellent source of labor force of each type of skill. However, because there is no recent data about the distribution of labor income across skill levels of labor, the Labor Force Sample Survey conducted by the Ministry of Planning in 1988 provides the data that was used to estimate such a distribution for each sector in 1995.

The parameters of indigenous labor supply equations are estimated by using yearly time-series data from the Ministry of Education, the PAAET, and Kuwait University. The indigenous and expatriate labor supply for each type of skill is distributed across sectors according to the base-year structure.

On the demand side, the Input-Output Table (1995) is the base source for computing the marginal propensity to save (and consume) for the private and government agents. It is also the source for computing the distributional parameters for private and government consumption demands, and the base for the distribution parameter of import demand. The sectoral distribution parameters are calculated as a ratio of the sector demand to the total private demand.

The national accounts statistic is the source for investment by the sector of destination, where the sectoral share of the investment represents the sectoral investment shares parameter (H_i). However, the capital composition matrix (S_{ij}) is calculated from the Input-Output Table as the shares of sectoral investment demand by sector of origin to the total investment.

CHAPTER V

THE POLICY SIMULATIONS

To achieve the objective of this study, this chapter focuses on analyzing three types of simulated policies. The impact of migration, indigenous human capital, and social policies on Kuwait's economy as a whole will be analyzed here.

This chapter is divided into three sections: the first introduces target and instrument variables used in policy simulations; the second presents the analysis of the migration policy (*MP*) simulations, in which the impact of a reduction both in all skills and in each individual type of skill of expatriate labor will be given; and the third addresses both indigenous human capital policy (*HCP*) and social policy (*SP*). The economic impact of human capital investment in education and the economic effect of a reduction in the retirement rate of indigenous labor are simulated through the production of educational system equations and the retirement rate of indigenous labor, respectively.

Target and Instrument Variables

Target variables are those variables looked at in evaluating the impact of a simulated policy. The emphasis in this study is on seven target variables: real GDP, real private consumption, real investment, surplus on current transactions, and the average wages of skilled, semi-skilled, and unskilled labor.

The real GDP reflects the overall performance of the economy. The effect of the simulated policy on the real GDP represents the general effect on the economy. As defined in the previous chapter, the GDP is the aggregation of wage, capital, and government incomes. It also represents, by definition, the value of goods and services produced in the domestic economy.

The real private consumption target variable, the consumption by households and producers of goods and services in real terms, represents the well-being of private consumers. A higher/lower wage and capital incomes are expected to drive the real private consumption up/down.

The next target variable, real investment, is endogenously determined by both domestic and foreign savings and the price of capital, in addition to a change in stocks, which is assumed to be constant. As a classical assumption, income that is not consumed is assumed to be saved.

The fourth variable, surplus on current transactions (*SCT*), is chosen as a target variable to represent transactions in the foreign market. *SCT* accounts for trade balance, foreign workers' remittances, net property and entrepreneurial income, and also the net transfer payment to the rest of the world, which is assumed to be constant in real terms. Greater net export and lower foreign workers' remittances are expected to boost the SCT.

Finally, the nominal average wages for each skill of labor are included as the last three target variables employed to represent the impact of simulated policies on labor markets. These wages are the outcome of supply and demand forces for each type of labor. A greater/smaller supply of certain skill of labor is expected to create an excess supply/demand of that skill of labor, putting a down/upward pressure on that wage. With

the exception of the SCT, which as a foreign exchange is expressed in dollars, and wages, which are expressed in Kuwaiti dinars (KD), all target variables are measured in millions of Kuwaiti dinars (KD).

This study utilizes the different types of labor skills as one of three instrument variables. An instrument variable can be described as a tool that the policy makers use to influence target variables. This initial instrument variable, the number of each type of skill of expatriate labor, is assumed to be directly controlled by the government migration policy through the permit licenses required for participation in the domestic labor market. Under the migration policy this study simulates a five percent reduction, first in all expatriate labor skills together and then in each type of skill individually. All target variables are expected to be influenced, either positively or negatively, as a result of the change in this instrument variable.

Government expenditures (investment) in education is the second instrument variable. More government expenditures on Kuwait University and PAAET (*KUEXP* and *PAASEXP*, respectively) is expected to enhance the quality and improve the structure of the indigenous labor force, which in turn will impinge upon the economy through the interactions between the economic variables, including the target variables. A 15 percent increase in investment, first in all types of education and then in each type individually, is simulated under human capital policy (*HCP*).

Finally, through the legislation of social security laws (higher retirement age), the policy makers can control the retirement rate of indigenous labor, which is the third instrument variable. The impact of a 10 percent reduction in the retirement rate of

indigenous labor on the target variables is simulated under what is called social policy (*SP*).

A quantitative analysis of the economic impact of these three policies, migration, human capital, and social, is based on the specifications of the dynamic CGE model presented in the previous chapter. As mentioned before, the time span of the study is a medium-length period of five years (1995-2000).

Migration Policy (*MP*)

Expatriate labor provides the Kuwaiti labor market with a ready supply of human resources that is necessary for the economic production of goods and services expected to promote economic growth of the economy. This kind of labor requires no heavy investment in human capital. Any restriction on the inflow of the number of expatriate laborers to the domestic labor market is expected to simultaneously cost and benefit the economy. This study does not intend to account numerically for the cost in opportunities created by expatriate labor; however, the dynamic CGE model developed in the previous chapter is utilized to examine the extent to which each type of skill of expatriate labor affects both various macroeconomic (target) variables and the growth of the economy.

Four different experiments related to the migration policy (*MP*) of all types of expatriate labor skills are used to achieve the objective. First, a reduction of all types of skills of expatriate labor is simulated, followed by experiments reducing each type of skill of expatriate labor individually. It is assumed here that the government has control over the inflow of each type of expatriate worker through work permits that allow them

to participate in domestic labor market. Table 12 presents the result of the impact of all migration policies on target variables.

Table 12

The Impact of Migration Policies on Target Variables

TARGET	1995	1996	1997	1998	1999	2000
1. **Real GDP**	**7924.923***	**8344.488**	**8458.358**	**8650.170**	**8938.338**	**8876.472**
MP1	7835.322	8242.321	8357.570	8526.828	8595.602	8845.049
MP2	7890.902	8306.169	8420.546	8606.491	8910.153	8683.212
MP3	7898.607	8314.370	8428.916	8609.975	8886.870	8574.765
MP4	7894.820	8309.811	8424.038	8607.850	8870.631	8423.765
2. **Real Private Cons.**	**3275.253**	**3463.975**	**3497.899**	**4631.602**	**4321.964**	**3870.047**
MP1	3217.326	3407.351	3441.785	4476.472	4295.192	3837.092
MP2	3256.297	3445.060	3479.082	4586.818	4056.929	3784.244
MP3	3258.508	3448.562	3483.014	4565.480	3935.939	3734.577
MP4	3252.224	3440.653	3474.605	4574.829	3900.926	3666.450
3. **Real Investment**	**1102.489**	**906.894**	**1014.616**	**1588.850**	**1614.946**	**1883.546**
MP1	1042.101	810.821	916.535	1545.296	1561.318	1820.171
MP2	1087.538	882.181	989.873	1578.413	1603.593	1864.162
MP3	1077.300	867.756	974.639	1569.943	1613.643	1849.985
MP4	1082.845	876.321	983.034	1573.024	1591.003	1847.273
4. **SCT**	**1862.888**	**2499.423**	**2494.076**	**15.596**	**561.193**	**1253.308**
MP1	1932.532	2576.682	2579.175	89.441	558.818	1333.830
MP2	1880.722	2519.654	2515.996	12.836	770.283	1291.878
MP3	1893.516	2532.906	2530.538	31.206	875.583	1318.591
MP4	1884.481	2523.417	2521.057	19.811	914.035	1320.962
5. **Average Wages**						
- **AW** (skilled)	**6667.605**	**7131.830**	**6600.635**	**5974.956**	**6342.564**	**6554.275**
MP1	6787.636	7231.804	6695.429	6103.699	5896.625	6727.798
MP2	6837.041	7307.504	6760.237	6127.541	6953.782	6497.628
MP3	6653.971	7103.699	6577.591	5978.144	6988.266	6204.024
MP4	6633.231	7086.637	6560.851	5954.653	7017.888	5991.782
- **AW** (semi-skilled)	**2596.463**	**2548.753**	**2496.549**	**3714.047**	**3561.057**	**3098.688**
MP1	2632.272	2582.866	2528.257	3766.724	3540.257	3190.707
MP2	2575.463	2527.306	2475.462	3687.219	3470.192	2998.709
MP3	2672.665	2624.221	2569.374	3819.427	3536.907	3044.768
MP4	2577.862	2529.574	2477.387	3687.990	3398.406	2865.250
- **AW** (unskilled)	**1242.861**	**1246.930**	**1160.102**	**1411.902**	**1417.731**	**1332.595**
MP1	1283.347	1284.801	1195.776	1461.612	1393.970	1396.391
MP2	1233.299	1236.601	1150.589	1402.927	1435.543	1285.300
MP3	1237.345	1240.346	1154.167	1406.361	1445.732	1260.724
MP4	1299.026	1302.404	1211.879	1477.236	1519.304	1284.997

MP1: A 5 percent reduction in all types of skill of expatriate labor.
MP2: A 5 percent reduction in skilled expatriate labor.
MP3: A 5 percent reduction in semi-skilled expatriate labor.
MP4: A 5 percent reduction in unskilled expatriate labor.
* Note: the bold numbers represent the reference run values.

Experiment Number One (*MP1*)

The impact of a 5 percent reduction of all types of skills of expatriate labor (combined migration policy) is analyzed here. Since expatriate labor constitutes a large portion of the total labor force, the 5 percent choice would be a both plausible and applicable number to base the analysis on. The announced government policy is to replace 10 percent of the foreign workers in the public sector with indigenous workers on an annual basis. However, the private sector absorbs most of the expatriate workers and depends on them increasingly. The reference run of this study assumes that the growth rate of each type of skill of expatriate labor will continue for the second half of the 1990s.

The reduction of expatriate labor in all skill categories by 5 percent (*MP1*) is equivalent to a reduction in total employment by 3.13, 3.514, and 4.881 percent (see Table 13), respectively, for skilled, semi-skilled, and unskilled labor in the base year 1995. The difference in the reduction of the labor force by skill groups depends on the share of expatriate labor in the total labor force by skill groups.

Table 13

The Impact of a 5 Percent Reduction in All Levels of Skill of Expatriate Labor on the Total Labor Force

	Base Year (1995)		Target Year (2000)	
Variable	**Reference**	**% Change**	**Reference**	**% Change**
Total Skilled Labor	187,287	-3.130	243,496	-2.830
Total Semi-Skilled Labor	299,740	-3.514	360,618	-3.418
Total Unskilled Labor	556,727	-4.881	710,703	-4.899

By definition, the GDP is the value of all goods and services produced domestically. The discussion about the impact of *MP1* on the first target variable (the

real GDP) will be influenced by the effect on domestic outputs and prices. The reduction in expatriate labor of all types of skills forces producers to cut total output (at least in the short run) simply because labor is, like capital, a primary factor of production. The total domestic output decreased by 1.25 percent in the base year (from KD 10,586.8 million to KD 10,454.4 million). However, substitutions between labor and capital will take place over time, lessening the reduction in output to 0.568 percent at the target year. The annual growth rate of the domestic output for the simulation period diminished by 0.158 percent over the reference run.

The effect on sectoral domestic output as a result of *MP1* is significant. It is expected that labor-intensive sectors, such as service, trade, and construction, which absorb expatriate labor, will suffer the most from the reduction of expatriate labor. The reduction in foreign participation in the total labor force by 5 percent for each skill leads to a reduction in the sectoral output of these sectors by 3.29, 1.376, and 2.32 percent (see Table 14), respectively, in the base year. Some sectors are less labor-intensive, but might suffer from the reduction of expatriate labor more than other sectors that are relatively labor-intensive. For example, transportation and agriculture absorb less expatriate labor, but the reductions in their outputs are 2.207 and 1.635 percent in the base year, respectively. To explain this result, we should note that the solution reflects a strong interaction between many economic variables. Moreover, the solution reflects inter-industry relations in an input-output table, so that the output of a certain sector feeds to other sectors by different fixed shares.

The sectoral output of the crude oil and petroleum products sectors are not affected much by *MP1* since they are highly capital-intensive sectors; the reduction in

their outputs are less than 0.5 percent. Moreover, the government is trying to protect the strategic sectors such as oil from any radical changes that affect their performance by training national labor force to assume positions in these important sectors, which should keep output reduction in these sectors low. However, the manufacturing sector is one of the special sectors that the government should be concerned about since its sectoral output is reduced by 1.587 percent as an immediate impact of *MP1*.

At the target year, the construction, agriculture, and manufacturing sectors suffer the most from restricting expatriate labor inflow. Their sectoral output is reduced, over the reference run, by 2.984, 1.808, and 1.662 percent, respectively. The government should take this result into account when forming such migration policy. Table 14 presents the sectoral change in outputs as a result of a 5 percent reduction in all types of skills of expatriate labor.

Table 14

The Impact of a 5 Percent Reduction of All Levels of Skill of Expatriate Labor on Sectoral Domestic Output (Percentage Change from the Base)

Sector	Base Year (1995)	Target Year (2000)
Agriculture	-1.635	-1.808
Crude Oil	-0.113	-0.139
Petroleum Products	-0.484	-0.483
Electricity and Water	-0.781	-1.025
Manufacturing	-1.587	-1.662
Construction	-2.320	-2.984
Trade	-1.376	-1.419
Transportation	-2.207	-0.944
Finance	-0.595	-0.686
Service	-3.290	0.568

The domestic price determination depends on the existence of an excess demand or supply of goods and services in each sector. As an outcome of this excess, domestic prices adjust. The results in Table 15 shows that there is no clear pattern in sectoral domestic prices as a consequence of a reduction of all types of expatriate labor by 5 percent; the domestic price of some sectors increased, while others decreased. The domestic price of the output of the service sector, as a labor-intensive sector, increased (as expected) in the short run by 2.605 percent. However, the domestic price of the construction sector achieved the highest percentage of decrease, 6.673 percent, in the short run, relative to the base value. The main reason for this high reduction in the domestic price of construction is the sharp decline in the demand for investment in that sector (as a result of the decline in domestic and foreign saving); the domestic price decreased in real terms by 5.795 percent. Given the reduction in the output of the construction sector, the decline in investment of that sector is strong enough to generate an excess supply for the output of that sector, which causes its prices to fall.

The reduction in total employment as a result of *MP1* cut down the real GDP in the base year (1995) by 1.131 percent over the benchmark value (from KD 7924.923 million to KD 7835.322 million). The wage, capital, and government annual incomes (the components of the GDP) reduced by 1.715, 1.771, and 0.096 percent, respectively. With respect to wage income, this means that the overall percentage decrease in the employment of different skills of labor outweigh the overall percentage increase in average wages. Over time, and due to capital-labor substitution, the reduction in real the GDP becomes 0.354 percent at the target year 2000. The mid-point elasticity of the real GDP with respect to overall expatriate labor is 0.227 at the base year, and only 0.071 at

the target year. This means that a one percent reduction in overall expatriate labor will lead to 0.227 and 0.071 percent reduction in real GDP at the base and target year respectively.

Table 15

The Impact of a 5 Percent Reduction of All Levels of Skill of Expatriate Labor on Sectoral Domestic Prices (Percentage Change from the Base)

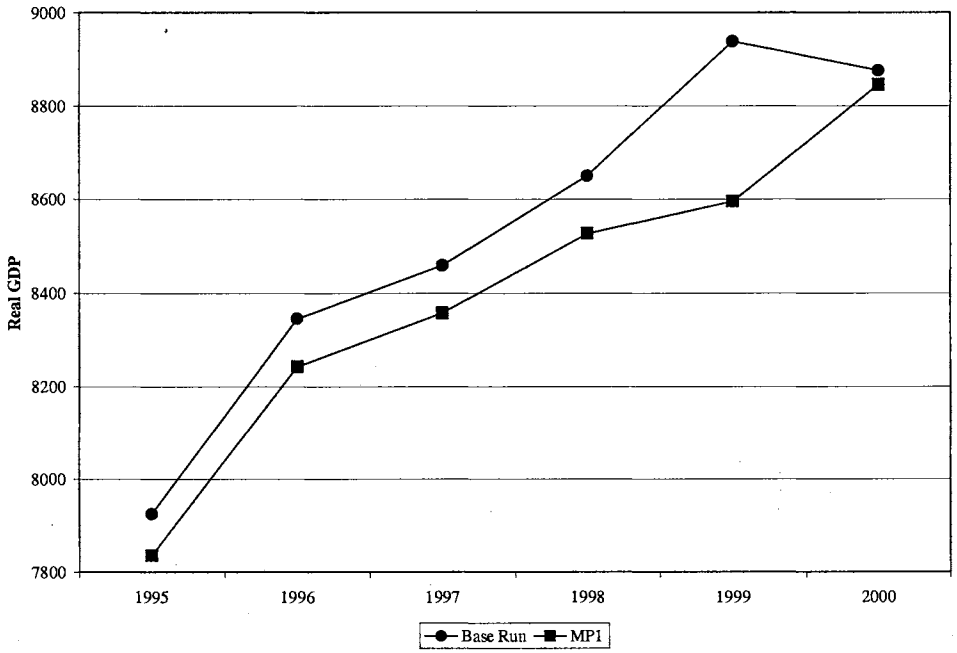
Sector	Base Year (1995)	Target Year (2000)
Agriculture	0.100	1.468
Crude Oil	0.000	0.000
Petroleum Products	0.300	0.437
Electricity and Water	-0.899	0.721
Manufacturing	-0.700	-0.077
Construction	-6.673	0.884
Trade	-0.400	0.863
Transportation	1.600	0.592
Finance	-1.399	-0.082
Service	2.605	-0.538

Figure 2 shows the performance of the real GDP under the reference run and the reduction in all skills of expatriate labor.

Because consumption depends on income, and because both wage and capital incomes are influenced negatively by the restriction on expatriate labor inflow, real private consumption (the second target variable) dropped by 1.769 percent as an immediate effect. This result indicates the role foreign workers play on the demand side, especially in the base year, before the adjustment process in the economy expands. At the target year, the impact reduced to 0.852 percent over the benchmark value, because capital-labor substitution alleviates reductions in income and capital wages.

Figure 2

The Real GDP Path for a Reduction in All Expatriate Labor by 5 Percent (*MP1*)



In addition to the *MP1*'s impact on income and private consumption, it also appears to have a significant impact on real investment, which diminished by 5.477 and 3.365 percent for the base and target years, respectively. The elasticity of real investment with respect to the overall expatriate labor supply is 0.684 at the target year. This means that a one percent decrease in expatriate labor will reduce real investment by 0.684 percent. The main reason for this impact on real investment is the reduction in total domestic saving (private and government) and foreign saving (improvement in the trade balance). Because imports are fixed proportions to the domestic outputs, as domestic outputs decrease, imports will follow. These effects overcome the effect of the small reduction in the price of capital, causing deterioration in real investment.

The closure rule that this study follows in the foreign market is that the exchange rate is pegged to a bundle of major foreign currencies from countries with which Kuwait has strong trade relations. On the other hand, the surplus on current transactions (SCT), or foreign exchange, fluctuates to clear the foreign market. This improvement in the trade balance contributes positively to the SCT, which increased over the reference run value by 3.738 and 6.425 percent for the base and target years, respectively. Expatriate workers are assumed to remit a fixed proportion of their wage incomes abroad. Since *MP1* reduced the wage income of expatriate labor, the remittances fall, reinforcing the positive impact of the trade balance on the surplus on current accounts. The remittances of expatriate workers reduced by 3.335 and 1.789 percent for the base and target years, respectively. The percentage change in SCT to the percentage change in overall expatriate labor supply at target year is high: -1.245. (Note that the Net Property and Entrepreneurial Income (NPEY) is determined exogenously in the model.)

The last target variables are the average nominal wages for each labor skill. The wage determination in the model depends on both supply and demand forces in each labor market. A reduction in expatriate labor of all levels of skill has a direct impact on the total supply of labor of all levels of skill. On the other hand, a reduction in the expatriate labor force affects the demand for laborers of each skill adversely and indirectly through cutting incomes and, hence, the aggregate demand for goods and services. The interaction between the supply of and demand for labor in each labor market leads to an equilibrium nominal wage for each skill of labor, which is equal to the marginal revenue product of each type of labor skill. The result here shows an expected

negative relationship between average nominal wages and the supply of expatriate labor in each skill category in both base and target years.

In the base year, the simulation result of *MP1* indicates that the average nominal wages for all types of labor increase over the benchmark values by 1.80, 1.349, and 3.257 percent for skilled, semi-skilled, and unskilled labor, respectively. As the impact of *MP1* on average wages accumulates over time, the increase in average wages at the target year becomes more apparent (see Table 12). The percentage rise in average wages reached 2.647, 2.97, and 4.787 percent, respectively, for skilled, semi-skilled, and unskilled labor in the target year. These increases in average wages can be supported by the fact that there are only limited substitutions between the types of labor since the reduction in the supply of labor comes from all skill levels. The impact of *MP1* on wages depends on the elasticity of the demand for each type of skill of labor and the ratio of output to each segment of labor skill. Thus, it is expected that unskilled laborers' average wages will have the highest increase as a result of the same percentage of reduction in each type of expatriate labor. The elasticity of the unskilled average wage with respect to overall expatriate labor is –0.935 at the target year, while it is –0.523 and –0.585 for skilled and semi-skilled average wages, respectively.

The impact of *MP1* on average wages indicates that the existence of expatriate labor of all types puts a downward pressure on average wages, especially the unskilled average wage. This might carry an opportunity cost by preventing some nationals from participating in the labor force. It also creates an incentive for unskilled indigenous labor, in particular, to move away from the private sector (where the share of expatriate labor in the market is higher) whenever an opportunity opens elsewhere.

In conclusion, the implementation of *MP1* leads to a reduction in total domestic output by 1.25 percent in the short run, which derives mainly from the service, construction, and transportation sectors. However, no significant impact occurs in the oil sectors, since it is a capital-intensive sector. *MP1* will lower the real GDP in the short run by 1.131 percent, but at the target year the impact on the real GDP is lessened by capital-labor substitutions to only 0.354 percent, relative to the benchmark value. That impact on the GDP reflects a decline in wage, capital, and government incomes by different rates in the short run. Real private consumption seems to be more sensitive to *MP1* than real government consumption, declining by 1.769 and 0.852 percent, respectively, in the base and target years. The changes in domestic saving and the trade balance forced the real investment to decline sharply by 5.477 and 3.365 percent for the same years, respectively. The decrease in remittances by foreign labor reinforces the improvement in the trade balance, which leads to a 6.425 percent greater inflow of foreign resources (SCT) at the target year.

Finally, the restricted migration policy regarding the inflow of all skill types of expatriate labor by implementing *MP1* tends to raise the average nominal wages of all skills of labor. The unskilled indigenous labor group will benefit the most from such a policy in both the short and medium runs, even though the result shows a long-run movement in the redistribution of average wages in favor of a class of semi-skilled labor, as a result of the relative wage movement. One implication of the downward pressure that the existence of expatriate labor puts on the average wages is that it might reinforce the tendency of some nationals to participate less in the labor force.

In this experiment (*MP1*), we present the aggregate impact of a reduction in expatriate labor with no differentiation between skills. Next, we will present a detailed result by separately simulating the impact of a reduction of each level of skill of expatriate labor.

Other MP Experiments

In these experiments the aggregate impact that in the previous experiment (*MP1*) is now separated according to each level of skill. The impact of a 5 percent reduction in expatriate labor of skilled (*MP2*), semi-skilled (*MP3*), and unskilled (*MP4*) workers are simulated individually. As mentioned before, these experiments are equivalent to a reduction in the total labor supply by 3.13, 3.514, and 4.881 percent for skilled, semi-skilled, and unskilled, respectively, in the base year. In addition to the supply-side impact of these experiments, they assert a reduction in demand for labor as incomes and, hence, consumption fall.

Expatriate labor is an important factor in the production of goods and services. Even though skilled expatriate labor constitutes only 13.5 percent of expatriate labor at the base year, a 5 percent reduction in its supply causes the highest short-run reduction in total output relative to other skill-levels of expatriate labor, 0.457 percent. That rate reached 2.139 percent at the target year.

On the other hand, as an immediate impact, restricting the inflow of unskilled expatriate labor reduced the total output by 0.428 percent, but at the target year, this reduction became the highest negative influence relative to other migration policies at 4.918 percent. Tables 16 and 17 present the impact of restricting the inflow of each level of skill of expatriate labor on sectoral outputs at the base and target years, respectively.

Table 16

The Impact of Reducing Skilled, Semi-Skilled, and Unskilled Expatriate Labor by 5 Percent on Sectoral Outputs at the Base Year (Percentage Change from the Base)

	Base Year (1995)		
Sector	***MP2***	***MP3***	***MP4***
Agriculture	-0.154	-0.142	-1.343
Crude Oil	-0.047	-0.056	-0.010
Petroleum Products	-0.174	-0.246	-0.065
Electricity and Water	-0.258	-0.491	-0.034
Manufacturing	-0.327	-0.874	-0.394
Construction	-0.569	-0.924	-0.845
Trade	-0.504	-0.326	-0.552
Transportation	-0.505	-0.726	-0.992
Finance	-0.297	-0.194	-0.106
Service	-1.454	-0.704	-1.167

Table 17

The Impact of Restricting Skilled, Semi-Skilled, and Unskilled Expatriate Labor by 5 Percent on Sectoral Outputs at the Target Year (Percentage Change from the Base)

	Target Year (2000)		
Sector	***MP2***	***MP3***	***MP4***
Agriculture	-0.008	0.062	-1.134
Crude Oil	-0.042	-0.038	-0.018
Petroleum Products	-0.171	-0.243	-0.093
Electricity and Water	0.040	-0.080	0.399
Manufacturing	-0.193	-0.687	-0.240
Construction	-0.702	-1.133	-1.156
Trade	-0.446	-0.282	-0.545
Transportation	-2.112	-2.932	-3.771
Finance	-0.276	-0.173	-0.129
Service	-9.426	-14.740	-22.855

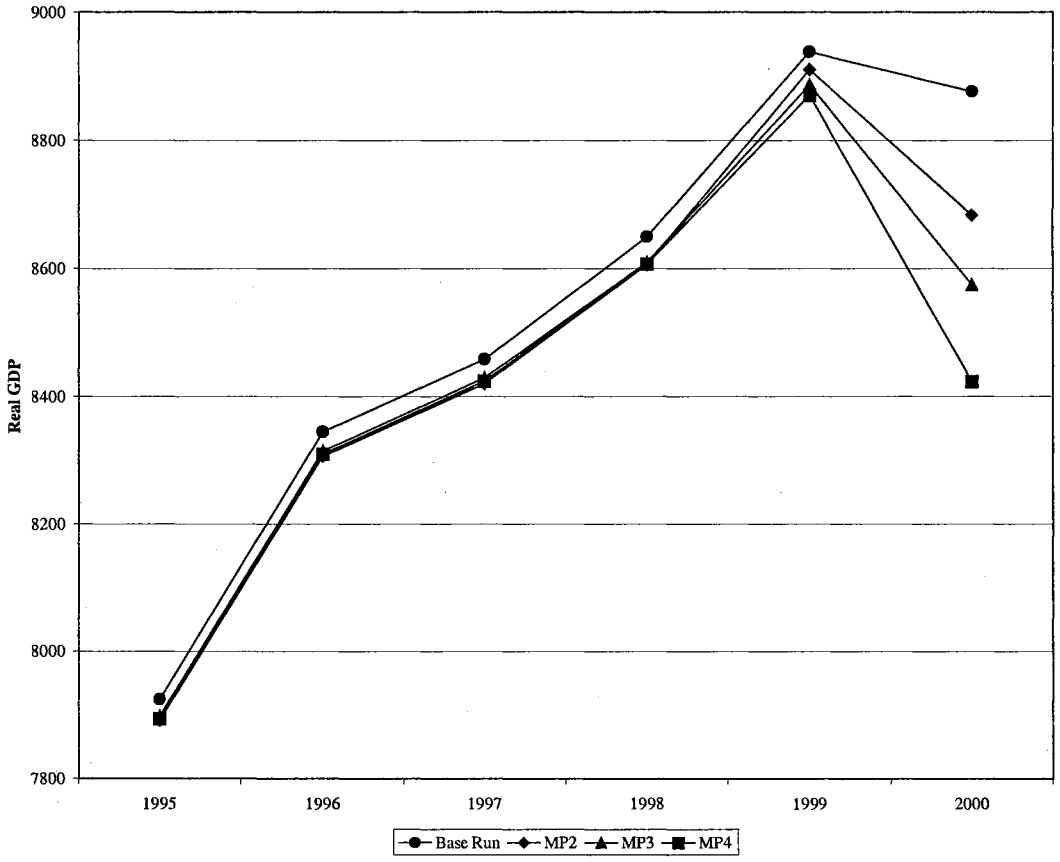
The following are some notes about figures presented in both tables. The output of the crude oil and petroleum products sectors do not appear to be sensitive to policies that restrict expatriate labor of each level of skill. The reason for this, as mentioned

before, is that they are capital-intensive sectors. The manufacturing sector's output is hurt the most by restricting semi-skilled expatriate labor and the output of the transportation sector appears to be responsive to the reduction of all skills of expatriate labor, especially at the target year. Finally, and most importantly, the service sector suffers a dramatic reduction in output in the target year as a result of restricting each type of skill of expatriate labor, especially the unskilled labor, where the reduction reached 22.855 percent. This result can be explained by the concentration of all types of skills of expatriate labor, including skilled, in that sector.

The real GDP, as an aggregation of incomes, was affected negatively by all individual experiments, especially at the target year. In the short run, restricting skilled expatriate labor (*MP2*) accounts for the highest reduction in the real GDP relative to the reference run value, 0.429 percent. Restricting unskilled expatriate labor (*MP4*) came next, then semi-skilled labor (*MP3*), by reducing the real GDP by 0.380 and 0.332 percent, respectively, while the reduction of all skills of expatriate labor combined (*MP1*) drops the real GDP by 1.31 percent. It is reasonable to expect that the combined policy (*MP1*) has a greater effect on the real GDP. Figure 3 offers a scenario of the real GDP paths for the reference run and for a reduction of each skill of expatriate labor.

Figure 3

Real GDP Under a Reduction of Each Skill f Expatriate Labor by 5 Percent



The results show that the individual policies, at the target year, reduce the real GDP by 2.177, 3.399, and 5.1 percent for *MP2*, *MP3*, and *MP4*, respectively, while the combined (*MP1*) accounts for only a 0.354 percent reduction in the real GDP. The elasticity of the real GDP with respect to a reduction in skilled, semi-skilled, and unskilled expatriate labor, at the target year, are 0.44, 0.692, and 1.047 respectively, while it is only 0.071 for the reduction of all levels of skills. This means that a one percent reduction in each level of skills of expatriate labor will reduce real GDP more than its reduction when all levels of skills of expatriate labor reduced by the same

percent. This surprising result can be explained by a higher accumulation of capital (more capital-labor substitution) in the case of a reduction of all types of expatriate labor (*MP1*). The increase in capital in case of *MP1* is a result of the limited substitutions between laborers of different skill levels when all types of labor are reduced. Table 18 presents the mid-point elasticity of the target variables with respect to instrument variables.

In fact, the capital stock increased at the target year by 0.25 percent when all skills of expatriate labor decreased by 5 percent, but the capital stock at the same year decreased by 0.472, 0.627, and 0.783 percent for the *MP2, MP3,* and *MP4* experiments, respectively. The capital-labor substitution is depressed in the individual experiments, since we expect more substitution between skills of labor as a result of a change in their relative prices.

One thing to remember here is that the assumption of a unitary elasticity of substitution between the levels of labor skills is adopted in this study. This may be a restrictive assumption which might not reflect reality very well, as not all sectors are expected to have a unitary elasticity of substitutions; however, the constraint is the availability of data.

Table 18

The Elasticities of Target Variables with Respect to Migration Instruments at the Target Year (2000)

Target Variable	MP1	MP2	MP3	MP4
Real GDP	0.071	0.440	0.692	1.047
Real Private Consumption	0.171	0.448	0.713	1.081
Real Investment	0.684	0.207	0.360	0.389
SCT	-1.245	-0.606	-1.015	-1.051
Nominal Average Wages				
- Skilled	-0.523	0.174	1.098	1.793
- Semi-Skilled	-0.585	0.656	0.351	1.566
- Unskilled	-0.935	0.723	1.109	0.727

All experiments affect the second target variable, real private consumption, adversely, especially at the target year. As a result of reductions in wage income by 8.188 percent and capital income by 6.533 percent, the real private consumption in case of *MP4* falls by 5.261 percent, relative to the reference run value in the target year. This number is equivalent to 1.081 elasticity of real private consumption with respect to unskilled expatriate labor (see table 18). The positive number of the elasticity reflects a positive relationship between the expatriate labor and the real private consumption. The size of the unskilled expatriate labor force can explain a large part of this result. The other individual policies affect the same target negatively through wage and capital incomes by reducing it by 3.5 and 2.217 percent for semi-skilled and skilled expatriate labor, respectively. This result can have a great influence on other macroeconomic variables through the price of domestic goods and the demand for labor services.

The impact of individual migration policies on the next target variable, real investment, appears to be more sensitive in the short run than at target year, except for

MP4. The elasticity of real investment with respect to unskilled expatriate labor, at the target year, is higher than other individual migration policies; it is 0.389, while it is 0.207 and 0.360 for skilled and semi-skilled, respectively. The mobility of capital between the sectors over time, according to profitability, can largely explain why the strength of the impact of individual migration policies decreased over time.

The combined policy seems to be more powerful in improving the surplus in current transactions than individual migration policies for each type of skill of expatriate labor, in both base and target years. *MP4* shows the next alternative in improving the status of the balance of payment by boosting the surplus in current transactions (SCT) at the target year by 5.398 percent over the reference run. The major contributors for such improvements are the reduction in remittances that expatriate laborers send abroad (decreased by 8.064 percent as a result of the reduction in their employment and, hence, changes in wages), and the improvement in the trade balance (increased by 10.219 percent). (Note that the Net Property and Entrepreneurial income is determined exogenously in the model.)

The impact of restricting the inflow of each level of skill of expatriate labor on average nominal wages is as follows. In the short-run, restricting the inflow of skilled expatriate labor (*MP2*) leads to an immediate jump in the skilled-labor average wage, reflecting the scarcity of this skill level in the market. The average nominal wage for skilled labor was boosted by 2.541 percent over the reference run value. The result indicates that the impact of the shortage in the skilled-labor supply in the market (direct effect) dominates the impact of the decrease in the demand for labor (indirect effect) as a result of the reduction in incomes, and then in the aggregate demand for goods and

services. However, the *MP2* exerts a small downward pressure on the average wages of other levels of labor skills. The semi-skilled and unskilled average wages fell by 0.809 and 0.769 percent, respectively, over the reference run values. This indicates a reduction in the demand for semi-skilled and unskilled workers as a result of a reduction in the aggregate demand for goods and services, although their labor supplies are intact.

Similarly, *MP3* (*MP4*) lead to a hike in the average nominal wage for semi-skilled (unskilled) labor by 3.935 percent (4.519 percent for unskilled labor). At the same time *MP3* (*MP4*) puts a smaller downward pressure on the average wages of other types of labor, reducing the average wages of skilled and unskilled workers by 0.204 and 0.444 percent, respectively (0.516 and 0.716 percent for skilled and semi-skilled as a result of *MP4*). Accordingly, *MP2* exhibits a higher influence on reducing the average wages for the other levels of labor skills at the base year.

The impacts of individual experiments at the target year show an unexpected result in the relationship between the average wage of a certain skill of labor and its supply. The reduction of each certain skill of expatriate labor reduces the average wages for all skills, especially for other skills. *MP4* exerts the highest impact in reducing the average wage for other skills of labor; it reduced the average wage for skilled and semi-skilled labor by 8.582 and 7.533 percent, respectively. This result indicates that the indirect (income and demand) effect, mentioned above, becomes much stronger over time than the direct (supply) effect.

In conclusion, all individual migration policies show a negative short-run impact on the real GDP; this impact accumulates over time to be much greater. Restricting

unskilled expatriate labor appears to exert the highest negative impact on the real GDP at the target year, achieving a 5.1 percent reduction of the benchmark value.

Since the impact of all individual migration policies on wage and capital incomes is negative, the reduction in private consumption at the target year ranges from 2.217 percent for *MP2* to 5.261 percent for *MP4*.

The real investment also shows a reduction at the target year by 1.029 percent for *MP2*, 1.782 percent for *MP3*, and 1.926 percent for *MP3*. However, the surplus in current transactions shows an improvement at the same year by 3.077 percent for *MP2*, 5.209 percent for *MP3*, and 5.398 percent for *MP4*.

The impact of a restricted migration policy for certain skills of expatriate labor on the average nominal wages depends on the time span of the analysis. In the short run, the restrictions raise the average nominal wage of the equivalent skill of expatriate labor significantly, which reflects the expected negative relationship between the supply of labor and the average wage. This result indicates the dominance of the direct (supply) effect. At the same time the policy tends to reduce the average nominal wages for other types of labor skills by a small rate, through an impact on the demand for these types of skills. The reduction of skilled expatriate labor appears to have a larger impact on reducing the average nominal wages of semi-skilled and unskilled workers. It reduces the former by 0.809 percent and the latter by 0.709 percent. The reduction of unskilled expatriate labor has a more indirect impact on the average wage of skilled workers, reducing it by 0.516 percent in the base year.

However, over time the impact of all individual migration policies that restrict certain skills of expatriate labor, surprisingly, will reduce the average nominal wages of

all types of labor, especially the average wage of other levels of skills. This result reflects the dominance of the indirect demand effect over the direct supply effect of a reduction of individual skills of expatriate labor. According to this result, all classes of households who depend on wage income would be hurt in the long run as a result of individual migration policies. The assumption of unitary elasticity of substitution mentioned above can be blamed for this result. Comparing the combined migration policy (*MP1*), where the substitution between skills of labor are depressed, with individual policies, the combined policy tends to have a moderate and expected positive impact on the average nominal wages in both the base and target years.

Human Capital and Social Policies

The simulation of policies that relate to the indigenous labor force is analyzed and discussed in this section under two subtopics, human capital policy, which relates to the investment in the education of indigenous labor, and social policy, which relates to the impact of the retirement rate of indigenous labor on the economy.

Human Capital Policy (HCP)

The second objective of this study is to simulate the economic impact of government investment in three types of education: first, university education, represented by Kuwait University;[12] second, applied education, represented by PAAET; and third, general education. The emphases will be on the first two types of education, both of which are types of higher education. The first factor for this focus is that the

[12] The government these days is evaluating the establishment of a private university in Kuwait as a second university in the country, which makes our simulation of a larger output of skilled indigenous labor meaningful in practice.

investment in general education will not only increase the number of people from that level of education who enter the labor market, but, more importantly, will also increase the number of students entering the next level of education. In other words, the impact of general education on the economy is a long-run phenomenon.

The second reason for focusing on higher education is the unavailability of data about the output of general education entering the labor force directly, which reinforces its weak connection with the labor market. However, the output of the higher education system is closely connected to the labor market through the educational system's production functions. The estimates of these equations are statistically significant and have their expected signs. The role expenditure on higher education plays is to make an impact on the economy by enhancing the quality of labor. In particular, investing in education improves the structure of the indigenous labor force. The following is the analytical result of the three experiments under the human capital policy (*HCP*).

Experiment Number One (*HCP1*)

In this experiment the model was used to simulate the impact of a 15 percent increase in investment in all types of education: Kuwait University, PAAET, and general education. *HCP1* is expected to increase the indigenous output of the educational system at all levels. According to the estimate of the educational production functions equation presented in the model, a 15 percent increase in resources allocated to all types of education leads to an increase in indigenous skilled and semi-skilled labor by 2.343 and 0.674 percents, respectively, at the target year (see Table 19). The growth rate of the skilled and semi-skilled indigenous labor force for the simulated period increased by 0.575 and 0.151 percent, respectively, relative to the reference run values.

Table 19

The Impact of a 15 Percent Increase of Investment in All Types of Education on Each Type of Indigenous Labor Force (Percentage Change from the Base)

	Base Year (1995)	Target Year (2000)
Skilled Indigenous Labor	0.428	2.343
Semi-Skilled Indigenous Labor	0.086	0.674
Unskilled Indigenous Labor	0.133	0.877

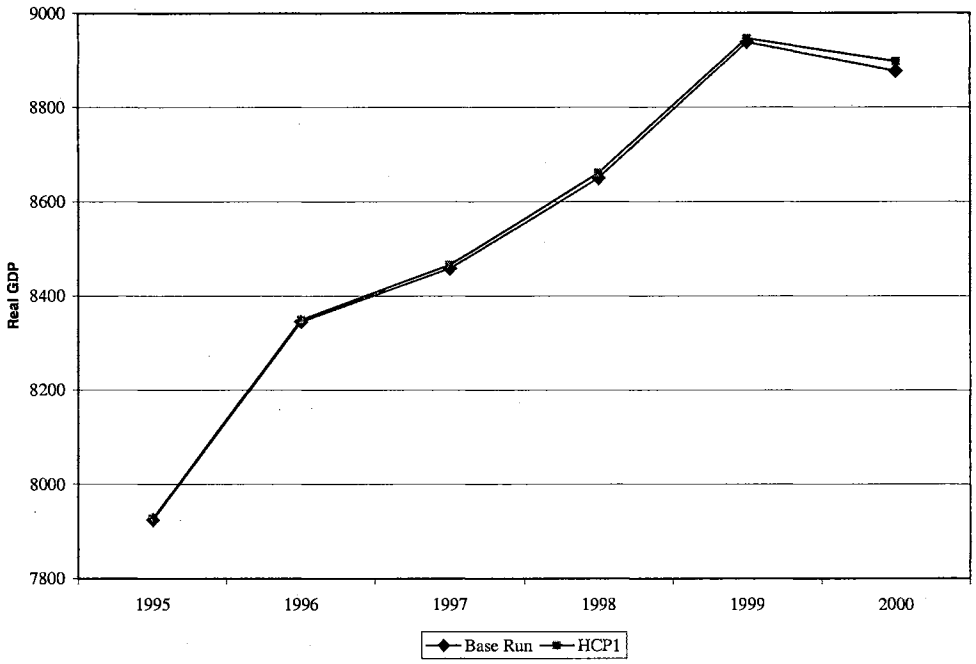
The difference between the growth rates of the output of skilled and semi-skilled indigenous labor depends on the estimate of the educational production function, as well as on the updated values of the exogenous variables over time for these equations. A simple forecast is used, based on recent available data, to determine the values of these exogenous variables.

The impact of *HCP1* on the GDP is generated by the improvement in domestic outputs of goods and services. More outputs at all levels of the educational system are expected to enhance the quality of indigenous labor, which reflects directly into the domestic outputs of goods and services in the economy. As a result of *HCP1*, total domestic output increased by 0.249 percent at the target year over the reference run value. The average annual growth rate of the total output increased by 0.048 percent over the reference run. Looking at sectoral changes in output indicates that most of the changes above come from the service sector (increased by 0.808 percent) and other labor-intensive sectors. As a result, real GDP improved at the target year by 0.235 percent (from KD 8,876.472 million to KD 8,897.334 million). The real GDP annual growth rate for the simulation period (1995-2000) increased by 0.048 percent over the reference run

growth rate. The result at the target year means that a one percent increase in government expenditure on all types of education will increase the real GDP by 0.016 percent. Figure 4 shows two real GDP paths, the reference run, and the path under the human capital policy that increases investment in all types of education by 15 percent.

Figure 4

The Real GDP Path as a Result of an Increase in Human Capital Investment in All Types of Skill of Indigenous Labor by 15 Percent



The result of *HCP1* shows that investment in indigenous human capital has a limited impact on the real GDP. This result can be contributed to several factors: first, the fact that the indigenous labor supply is only a small proportion of the total labor force; which indicates that increased numbers of skilled indigenous laborers cannot have a large impact on the real GDP, at least in the short and medium runs. Second, investment in human capital is a long-term phenomenon, requiring a long time lag for the

investment in education to have an impact on the labor market and, in turn, the economy. And third, the model accounts for only Kuwaiti graduates. "Bidoons" and Arabs who have lived in Kuwait for a relatively long period of time are excluded, which can lead to an underestimation of the output of the educational system and, hence, the impact of investment in human capital on the economy. Table 19 presents the impact of human capital and social policies on all target variables.

A more generous government investment in all types of education can improve the indigenous labor supply; however, since the impact on the labor market is relatively small, the investment's effect on the price levels of domestic products is also small. The consumer price index (CPI) is defined as domestic sectoral prices weighted by sectoral consumption shares. The result shows that there is not much change in inflation, the growth of the CPI, as a result of *HCP1*. However, small sectoral changes in domestic prices do occur as a result of the existence of an excess supply or excess demand for each sector.

Since the impact of *HCP1* on wage and capital incomes is expansionary (they increased in the target year by 0.36 and 0.298 percent, respectively), it is expected that private consumption will be influenced positively because the model assumes a fixed saving rate. The real private consumption at the target year increased by 0.282 percent over the reference run value.

Table 20

The Impact of Human Capital and Social Policies on Target Variables

TARGET	1995	1996	1997	1998	1999	2000
1. Real GDP	**7924.923***	**8344.488**	**8458.358**	**8650.170**	**8938.338**	**8876.472**
HCP1	7926.854	8349.106	8465.453	8661.428	8947.008	8897.334
HCP2	7926.646	8348.603	8464.615	8659.866	8945.877	8894.387
HCP3	7925.112	8344.949	8459.135	8651.630	8939.326	8879.434
SP	7925.914	8346.546	8461.407	8655.132	8941.849	8886.013
2.Real Pvt. Consum.	**3275.253**	**3463.975**	**3497.899**	**4631.602**	**4321.964**	**3870.047**
HCP1	3276.349	3466.265	3501.460	4643.285	4342.841	3880.978
HCP2	3276.213	3466.000	3501.015	4640.748	4339.110	3879.182
HCP3	3275.374	3464.211	3498.301	4633.993	4325.869	3871.815
SP	3275.839	3465.012	3499.450	4637.649	4332.567	3875.222
3. Real Investment	**1102.489**	**906.894**	**1014.616**	**1588.850**	**1614.946**	**1883.546**
HCP1	1103.428	910.120	1019.607	1591.850	1618.564	1890.244
HCP2	1103.238	909.481	1018.531	1591.131	1617.768	1888.564
HCP3	1102.667	907.498	1015.640	1589.529	1615.676	1885.148
SP	1103.099	908.675	1017.276	1590.467	1616.759	1887.145
4. SCT	**1862.888**	**2499.423**	**2494.076**	**-15.596**	**561.193**	**1253.308**
HCP1	1862.102	2497.565	2490.788	-21.083	547.460	1245.361
HCP2	1862.301	2498.041	2491.661	-19.685	550.278	1247.608
HCP3	1862.699	2498.967	2493.238	-16.927	558.226	1251.119
SP	1862.319	2498.265	2492.151	-18.644	553.824	1248.790
5. Average Wages						
- AW (skilled)	**6667.605**	**7131.830**	**6600.635**	**5974.956**	**6342.564**	**6554.275**
HCP1	6659.306	7113.135	6574.852	5941.075	6274.368	6511.520
HCP2	6659.189	7112.664	6574.202	5941.089	6278.012	6509.566
HCP3	6667.700	7132.249	6601.220	5974.896	6338.255	6556.26
SP	6664.744	7126.447	6593.344	5964.444	6316.328	6542.864
- AW (semi-skilled)	**2596.463**	**2548.753**	**2496.549**	**3714.047**	**3561.057**	**3098.688**
HCP1	2597.004	2549.860	2498.106	3715.902	3563.669	3103.167
HCP2	2597.526	2551.063	2500.032	3719.924	3568.555	3108.120
HCP3	2595.929	2547.529	2494.591	3709.972	3556.193	3093.766
SP	2595.893	2547.672	2495.024	3710.777	3557.553	3095.931
- AW (unskilled)	**1242.861**	**1246.930**	**1160.102**	**1411.902**	**1417.731**	**1332.595**
HCP1	1243.350	1248.080	1161.742	1414.031	1418.257	1337.232
HCP2	1243.345	1248.046	1161.677	1413.973	1418.512	1336.906
HCP3	1242.900	1247.031	1160.256	1412.112	1417.630	1333.166
SP	1243.068	1247.364	1160.701	1412.646	1417.582	1334.483

HCP1: A 15 percent increase in investment in all types of education.
HCP2: A 15 percent increase in investment in KU education.
HCP3: A 15 percent increase in investment in PAAET education.
SP: A 10 percent reduction in the retirement rate for indigenous labor.
* Note: the bold numbers represent the reference run values.

The increase in imports as a result of the expansion of domestic output, in addition to only a small change in the price of exports due to a change in domestic prices, reduces the trade balance by 2.462 percent at the target year. The overall effect on the balance of payments as a result of these changes would be negative. The surplus in current transactions (SCT) fall by 0.634 percent at the same year. The elasticity of SCT with respect to investment in all types of education is –0.042.

The reduction in trade balance represents more resources invested in the domestic economy (foreign capital inflow). *HCP1* also simulates total domestic saving by increasing it by 0.292 percent at the target year. This effect, in addition to the higher foreign saving, mentioned above enhances real investment by 0.356 percent at the target year.

According to neoclassical theory, the wage differential between sectors or regions is eliminated by the assumption of mobility in the labor factor of production; the labor force will move between sectors or regions looking for higher returns. In the competitive market, the nominal wage is expected to equal the marginal revenue product of labor. In the Kuwaiti labor market, however, a wage differential exists between the economic sectors. The model accounts for this rigidity in the labor market. It is specified so that each sector or level of labor skill has a different wage, which results in solving for 30 wages. This study assumes that this wage differential reflects an equal differential in the marginal product of labor. For example, the higher wage in the oil sector reflects the higher productivity of labor in that sector, relative to other sectors.

In a neoclassical modeling of the labor market, the higher supply of one type of labor is expected to put a downward pressure on its relative wage rate. The result here

shows that a larger supply of indigenous labor of all types of skills due to investment in all types of education reduces the average nominal wage for skilled labor by 0.652 percent at the target year, relative to the reference run value. However, the result also exhibits a small increase in average nominal wages for semi-skilled and unskilled workers by 0.145 and 0.348 percent at the target year, respectively, relative to reference run values.

The labor wage is determined by the interaction between the demand for and the supply of labor. The demand for labor is driven by the aggregate demand for goods and services. A higher supply of labor might stimulate the economy by increasing income and, hence, the demand for goods and services. This in turn would provoke the demand for labor and could lead to a higher wage for other skills of labor. In partial equilibrium models, there is only one labor market; a greater labor supply will guarantee a fall in the labor wage, if the market is stable. However, we deal here with three labor markets and a high interaction with other economic variables. In particular, the small increase in the average nominal wage of semi-skilled and unskilled labor is not driven directly by a higher supply of PAAET and general education graduates, but influenced by the domination of the indirect income and demand effects over the supply effect of these skills of labor. This indicates that the production process in these educational institutions is not strong enough to counteract the labor demand forces generated by *HCP1*.

In the next two experiments, the impact of investment in higher education on the Kuwait economy is separated into two experiments. The first concerns the economic impact of investing in Kuwait University, and the second examines the investment in applied studies (PAAET).

Other Human Capital Experiments

Two experiments will be analyzed in this section. First, the economic impact of a 15 percent increase in government investment in Kuwait University (*HCP2*) is investigated; second, a 15 percent increase in government investment in applied studies, represented by PAAET (*HCP3*), is simulated.

The model allows us to trace the effect of *HCP2* and *HCP3* through the equilibrium points of various macroeconomic variables and also over a medium time span. The *HCP2* and *HCP3* allow for an expansion in Kuwait University education and PAAET education in both human and material resources, which permit a greater output from these institutions.

As mentioned in Table 19, *HCP2* and *HCP3* lead to an increase in the skilled and semi-skilled indigenous labor force by 0.428 and 0.086 percent, respectively, in the first year. At the target year, these rates increased to 2.343 and 0.674 percent, respectively. As in the previous experiment, we can say that *HCP2* and *HCP3* have no impact on the CPI over time, or inflation, but they have a small changes in sectoral domestic prices occur as a result of small changes in sectoral supply and demand of domestic outputs.

Table 21

The Elasticities of Target Variables With Respect to Human Capital and Social Instruments at Target Year (2000)

Target Variable	HCP1	HCP2	HCP3	SP
Real GDP	0.016	0.013	0.002	-0.011
Real Private Consumption	0.019	0.016	0.003	-0.013
Real Investment	0.024	0.018	0.006	-0.019
SCT	-0.042	-0.030	-0.012	0.036
Nominal Average Wages				
- Skilled	-0.044	-0.046	0.002	0.017
- Semi-Skilled	0.010	0.020	-0.011	0.009
- Unskilled	0.023	0.022	0.003	-0.014

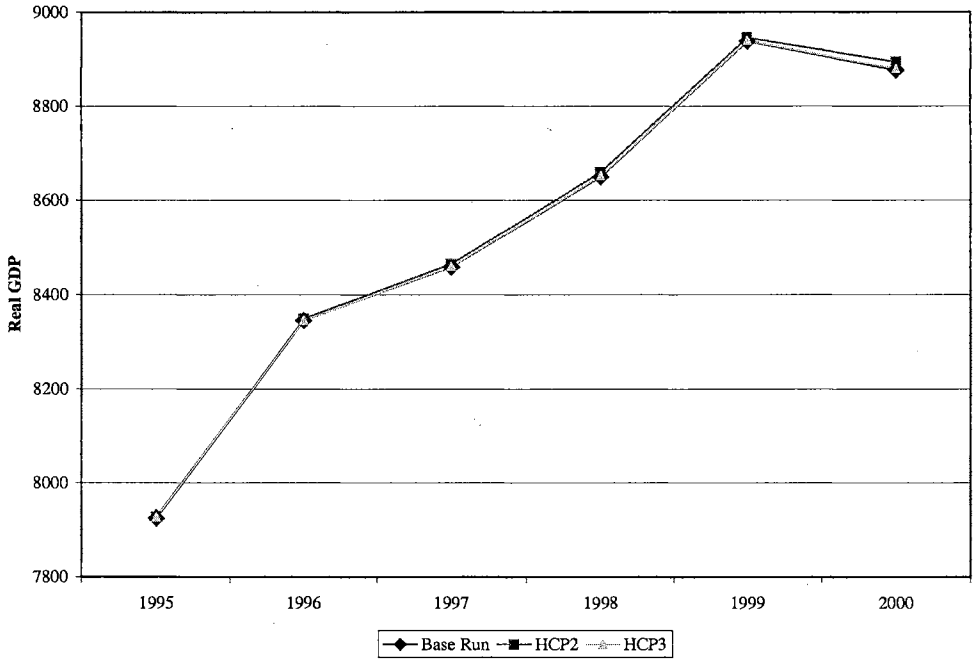
An increase in the skilled and semi-skilled indigenous labor supply as a result of *HCP2* and *HCP3*, respectively, is expected to stimulate the economy and enhance output. The demand for labor is governed by the cost of that factor of production. The reduction in the skilled and semi-skilled labor wage as a result of *HCP2* (*HCP3*) is supposed to provoke the demand for these types of labor to clear the market, thereby increasing total output. The result of *HCP2* shows an increase in total output at the target year by 0.178 percent over the reference run. This small increase in total output can be attributed to the sectoral output of the labor-intensive service sector and other labor-intensive sectors. However, *HCP3* does not appear to have a significant impact on either total or sectoral output.

The growth rate of the real GDP is accelerated at the target year by 0.202 percent for *HCP2*, but only by 0.033 for *HCP3*. This means that a one percent increase in expenditure in skilled and semi-skilled education will lead to increase in real GDP by 0.013 and 0.002 percent respectively (see table 21). In a comparison with the impact of

HCP1, the investment in Kuwait University education (*HCP2*) accounts for most of the improvement in the GDP growth performance in *HCP1*, even though the impact is small. Figure 5 shows the real GDP paths as a result of a15 percent increase in indigenous human capital investment in both Kuwait University and PAAET, separately.

Figure 5

The Real GDP Path as a Result of an Increase in Human Capital Investment in Skilled and Semi-Skilled Indigenous Labor by 15 Percent



With accounting for the higher private (wage and capital) income, and sectoral domestic price changes, a one percent increase in expenditures in skilled and semi-skilled education will lead to 0.016 and 0.003 percent increase in real private consumption.

Total investment in the model is determined by total saving in the economy, which includes both domestic and foreign saving, in addition to changes in capital stocks.

Higher wage, capital, and government incomes make more funds available for investment. Total domestic saving increased at the target year by 0.252 and 0.041 percent due to *HCP2* and *HCP3*, respectively. These are the main factors for higher real investment, which increased by 0.266 and 0.085 percent for *HCP2* and *HCP3*, respectively. The elasticities of real investment with respect to expenditures in skilled and semi-skilled education are 0.018 and 0.006 respectively.

The reduction in the amount of wage income that foreign labor receives and then remits abroad is small and cannot keep the balance of payments from deteriorating as a result of the reduction in trade balance. Thus the surplus in current transactions (SCT) scores a reduction at the target year of 0.455 and 0.175 percent due to the *HCP2* and *HCP3*, respectively. These numbers are equivalent to –0.03 and –0.012 elasticities of SCT with respect to expenditures in skilled and semi-skilled education.

As a result of a larger highly skilled and semi-skilled indigenous labor supply, the average wages will adjust. The result presented in Table 20 shows that a larger skilled indigenous labor supply, as a result of *HCP2,* will generate an excess supply of labor of that type, this excess, however, is eliminated by a decrease in the skilled average nominal wage of 0.682 percent for the target year. Investment in semi-skilled indigenous human capital (*HCP3*) increases the supply of semi-skilled labor, putting downward pressure on the average wage for the same type of skill. The average nominal wage for semi-skilled workers fell by 0.159 percent over the reference run values at the target year.

However, the result shows that a larger supply of certain types of labor skills leads indirectly to higher wages for other levels of labor skills through income and demand effects. For example, *HCP2* increases the average wage for semi-skilled and

unskilled labor at the target year by 0.304 and 0.324 percent, respectively. Also, the *HCP3* increases the average wage for skilled and unskilled labor at the same year by 0.030 and 0.043 percent, respectively. These results can be explained through the impact of individual human capital policies on the demand side, in the same manner as explained in previous individual experiments.

Social Policy (SP)

Job experience is one of the well-known ways of accumulating knowledge and enhancing the productivity of human capital. The gradual rise in the age of retirement for indigenous labor as an implementation of the new changes in the social security law[13] is supposed to allow for more utilization of indigenous human capital. The growth and quality of the indigenous labor force would permit, and even enhance, more human capital accumulation.

In this experiment (*SP*), the impact on the labor market and on the economy as a whole of a 10 percent reduction in the retirement rate of the indigenous labor force is simulated over the second half of the 1990s.

The immediate impact of *SP* in the labor market is that it leads to a 0.156 percent rise in the indigenous labor supply of all types of skills over the benchmark values. This result is implied by our calibration of the indigenous labor supply equation to reproduce the actual data in the base year. It is expected that skilled labor has a lower retirement rate than less-skilled labor; however, due to the unavailability of data, all skills of labor are assumed to have the same retirement rate. At the target year, the indigenous labor

[13] The new changes in the social security law are discussed in Chapter II.

supply was enhanced by 0.74, 0.807, and 0.875 percent for skilled, semi-skilled, and unskilled, respectively, over the benchmark values (see Table 22)

The total domestic output increased as a result of *SP* by 0.113 percent at the target year, with the service sector achieving the highest increase in its output, 0.352 percent.

Table 22

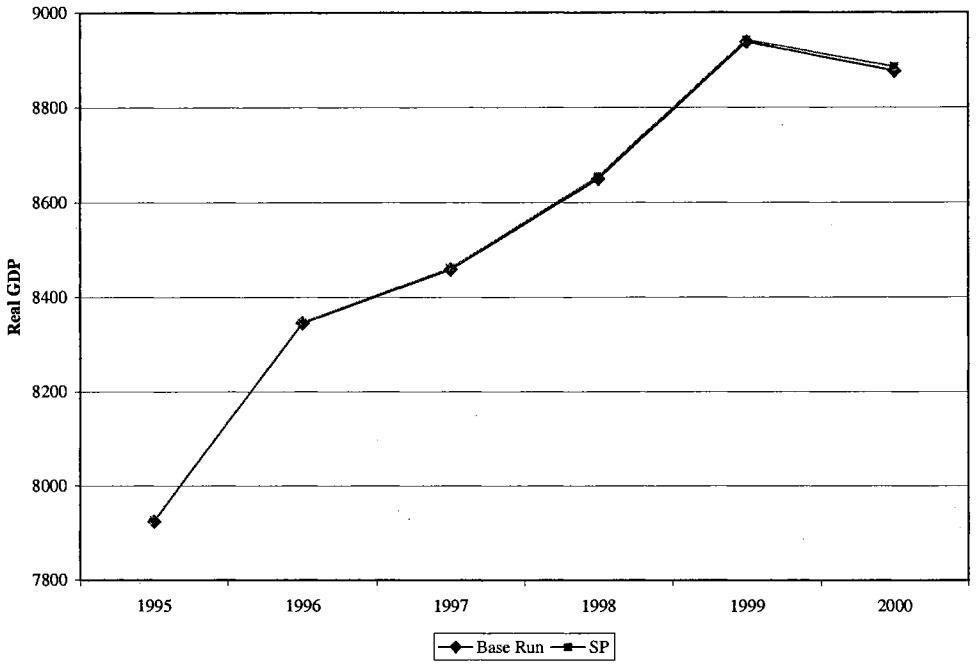
The Impact of a 10 Percent Increase in the Retirement Rate on the Indigenous Labor Force (Percentage Change from the Base)

	Base Year (1995)	Target Year (2000)
Skilled Indigenous Labor	0.156	0.740
Semi-Skilled Indigenous Labor	0.156	0.807
Unskilled Indigenous Labor	0.156	0.875

The real GDP is only influenced marginally by the 10 percent reduction in the retirement rate over short and medium terms. It increased by 0.107 percent over the reference run value at the target year. The small share of indigenous labor in the total labor force can justify this result. Figure 6 shows the performance of the real GDP over the second half of 1990s, for both *SP* and the reference run.

Figure 6

Impact of Reduction in the Retirement Rate of
Indigenous Labor on the Real GDP



Although the domestic prices for labor-intensive sectors such as the service sector decrease as a result of a higher domestic supply in these sectors, other sectoral domestic prices are increased, which in turn affects the increase in real consumption negatively. Real private and government consumption is raised by 0.134 percent over the reference run value at the target year.

After accounting for the slight increase in the price of capital, defined as a weighted average of domestic prices, real investment increased at the target year by 0.191 percent, mainly because of higher foreign saving (increased by 1.4 percent) and a slight increase in domestic saving.

Unlike the real investment and other macroeconomic variables, however, the surplus on current transaction (SCT) decreased by 0.36 percent over the benchmark value, due primarily to a deterioration in the trade balance.

Since the indigenous labor supply increases due to an investment in human capital, the average nominal wages are expected to be lower than the benchmark values. This result shows that the impact on average wages starts with a weak short-run effect, but grows over time as the size of the indigenous labor force becomes larger. The average nominal wages for skilled and semi-skilled workers decreased at the target year by 0.174 and 0.089 percent, respectively. However, *SP* put an upward pressure on the average nominal wage for unskilled labor, which increased by 0.142 percent at the same year. This indicates that the increase in supply of unskilled labor is not strong enough to counteract the demand forces driven by *SP*.

Given the increase in the labor supply, the reduction in skilled and semi-skilled labor wages are not strong enough to pull the wage income down. Both wage and capital incomes are increased by 0.156 and 0.145 percent, respectively, at the target year. The change in capital income is due to a higher value added as a result of both a higher output and a marginal increase of domestic prices for some sectors.

In conclusion, the 10 percent reduction in retirement rates allows for the accumulation of indigenous human capital over time. The investment increased total domestic output by 0.113 percent at the target year, while the real GDP increased at the target year by only 0.107 percent over the reference run value.

As a result of the small increase in wage, or capital incomes, real private consumption increased by 0.134 percent. As in the human capital policy, the 10 percent

reduction retirement rate expands the real investment and reduces the surplus in current transactions.

The reduction in the retirement rate (*SP*) increases the supply of indigenous labor, thus having a limited effect on the reduction in the average wages of skilled and semi-skilled labor. However, it increases the unskilled wage slightly.

Generally, the impact of the 10 percent reduction in the retirement rate on the major macroeconomic variables is small and can be classified in terms of its impact as an intermediate between the 15 percent increase in investment in skilled human capital and the 15 percent increase in the investment in semi-skilled human capital.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study investigates the role of expatriate and indigenous human capital in Kuwait economy as a special case. The study has three objectives: the first is aimed at estimating quantitatively the role of expatriate labor on the economy by simulating a reduction in their participation in the total labor force of Kuwait; the second is aimed at determining the impact of investing in different types of education on the economic growth and the major economic variables of the Kuwait economy; third, the study intends to simulate the impact of a reduction in the retirement rate of indigenous labor on the Kuwait economy.

In Chapter II, the distinctive demographic features of Kuwait's population and labor force are pointed out. These features include the structure and trend of the population and the labor force by nationalities, sex, age, and educational levels in addition to the structure and trend of the labor force by occupations and economic sectors. The focus is on the role that government and the supply side of the educational system play on the labor market.

In Chapter III, the labor migration theoretical and empirical literature is reviewed in the first part with emphasis on the empirical migration studies that are relevant to the Kuwaiti economy. In the second part, an extensive review of the Computable General Equilibrium (CGE) studies and its classification is discussed.

The structure of the dynamic CGE model is presented in Chapter V. A constant returns to scale Cobb-Douglas production function with capital and three types of labor is used in this model. Expatriate labor is treated as exogenous; however, indigenous labor is endogenously determined by the educational production functions to serve the objectives of the study. The model simulated the performance of the Kuwait economy for the second part of the 1990s by updating capital and the three levels of labor in addition to exogenous variables.

The analysis in Chapter IV focuses on the impact of migration, human capital, and social policies on the Kuwait economy. In the first part, the effect of a reduction in all and each levels of skill of expatriate labor on the economy is given. In the second part, the impact of human capital investment in all and each level of education, and the reduction in the retirement rate of indigenous labor on Kuwait economy is presented. The analysis is based on the impact of a change in instrument variables on seven target variables. These target variables are the real GNP, the real private consumption, the real investment, the surplus on current transactions, and the average nominal wages for each skill of labor.

The main findings and policy implications of the study can be classified under migration, and indigenous human capital polices.

Migration

1. The existence of expatriate labor of all skills put a significant downward pressure on average wages of all skills in both the short- and medium-runs. The result of *MP1* shows that a one percent decrease in all skills of expatriate labor will lead to a rise in skilled, semi-skilled and unskilled average wages by 0.523, 0.585, and 0.935 percent

at target year, respectively. The implication of this conclusion is that the indigenous labor, especially the unskilled, might be influenced regarding their participation in the labor force negatively.

2 Migration policy that restricts the inflow of expatriate labor will have a significant indirect (demand) impact on the wages and other macroeconomic variables in addition to the direct supply effect. For example, the individual migration policies that restrict one level of skill of labor raise the wage for that skill, but reduce the wages for other levels of skill of labor, in the short run. However, the medium-run results exhibit the domination of the indirect (demand) effect over the supply effect on the average wages for all skills. Thus, the average wages of all skills are reduced as a result of the individual policies at the target year.

3 Labor-intensive sectors such as service and transportation suffer the most in the short run by restricting the inflow of all types of expatriate labor. The result of *MP1* shows that their outputs are reduced by 3.29 and 2.207 percent, respectively in the short run. The same policy influences the output of the construction sector in both the short- and medium-runs significantly, by 2.32 and 2.984 percent, respectively. Even though the domestic price of the output of that sector fall sharply in the short run (by 6.673 percent) as a result of a high reduction in the investment demand of that sector. The policy makers should take the impact of migration policies on sectoral domestic production into account when forming such policies.

4 The overall economic impact of the reduction in all skills of expatriate labor is significant, especially in the short run. A one percent reduction in all levels of skills (*MP1*) will leads to a 0.227 percent fall in the real GDP of the base year. However,

due to capital-labor substitution that rate was reduced to only 0.071 percent at the target year.

The implication of this result is that the policy makers should animate both capital and financial market forces to speed up the capital-labor substitution process which will result in enhancing the productivity of indigenous labor and make the reduction in expatriate labor less painful to the economy. In addition to the impact of *MP1* on the real GDP, it influences the real investment considerably at the base and target years by reducing it by 5.477 and 3.365 percent, respectively. On the other hand, *MP1* boosts the SCT by 3.78 and 6.425 percent, respectively for the same year, which can be attributed to the improvement in the trade balance and a reduction in foreign workers' remittances.

5. The result of restricting certain skills of expatriate labor (*MP2*, *MP3,* and *MP4*) shows a considerable reduction in the real GDP and some other macroeconomic variables which could exceed the impact of restricting all skills of expatriate labor (*MP1*). This result could be explained by a less capital-labor substitution in the cases of *MP2*, *MP3,* and *MP4* and a high capital- labor substitution in the case of *MP1*.

   In fact, the capital stock increased at the target year by 0.25 percent when all skills of expatriate labor decreased by 5 percent, but the capital stock at the same year decreased by 0.472, 0.627, and 0.783 percent for the *MP2, MP3* and *MP4* experiments, respectively. The capital-labor substitution is depressed in the individual experiments since more substitution between skills of labor is expected as a result of a change in their relative prices was expected.

Indigenous Human Capital

Greater government investment in all types of education by 15 percent (*HCP1*) enhances the output of Kuwait university by 2.343 percent at the target year, whereas the output of the four colleges of PAAET increased by only 0.674 the same year. The implementation of *HCP1* appears to have a small impact on the real GDP and other macroeconomic variables. The real GDP increased at the target year by 0.234 percent as a result of *HCP1*. Most of that impact was generated by investment in Kuwait University (*HCP2*), which alone raise the real GDP by 0.202 percent at the same year.

Thus, even though the economic returns to investment in education is small, it is much larger in the case of investment in Kuwait University than investment in the four colleges of PAAET. The reasons behind the small impact of investment in indigenous labor on the economy are the following factors: first, the fact that the indigenous labor supply is only a small proportion of the total labor force; thus, more skilled indigenous labor cannot have a large impact on the real GDP, at least in the short- and medium-terms. Second, investment in human capital is a long-term phenomenon, requiring a long time lag for the investment in education to have an impact on the labor market and, in turn, the economy. And third, the model accounts for only Kuwaiti graduates. "Bidoons" and Arabs who have lived in Kuwait for a relatively long period of time are excluded, which can lead to an underestimation of the output of the educational system and, hence, the impact of investment in human capital on the economy.

The social policy that reduces the indigenous labor retirement rate by 10 percent will have no significant impact on macroeconomic variables. A one percent reduction in that rate increased the real GDP by only 0.011 percent.

One implication can be drawn from the human capital simulation results is that the educational system in Kuwait is not expected to have a significant impact on macroeconomic variables or to replace expatriate labor in the near future. However, by investing in university education and other policies such as more utilization of indigenous human capital and mechanizing activities the macroeconomic variables could be influenced and a high percentage of skilled foreign workers could be replaced.

Finally, the study assumes a unitary elasticity of substitution between factors of production implicitly. With the availability of data, the results could be improved, especially for individual policies that focus on one skill of labor, by utilizing constant elasticity of substitution (*CES*) or nested *CES* that allows for different elasticity of substitution between different sets of factors. Also, a differentiation between the returns to indigenous and expatriate labor would be considered an important future extension of this study.

REFERENCES

Adelman, I. and Robinson. S. (1978) *Income Distribution Policy in Developing Countries: A Case of Korea*, Stanford University Press, California

Adelman, I. and Robinson. S. (1988) "Macro Adjustment and Income Distribution: Alternative Models Applied to Two Economies," *Journal of Development Economics*, 29, 23-44.

Al-Awadi, A. "Strategic Dimensions for Coming Development Plan in the Light of the Outcome of Current Development Plan," College of Business, Economics, and Political Science Symposium, December 1989, Kuwait.

Al-Ebrahim, Y. (1995) "Labor Market Trends in Kuwait Economy," Graduates Association (Development and Requirements of Labor Market Conference), January.

Alessa, S. (1981) *The Manpower Problem in Kuwait*, Kegan Paul International: London.

Al-Humood, M. and Al-Quisi, I. "Development of Kuwaiti Labor Market," Graduates Association (Development and Requirements of Labor Market Conference), January 1995.

Al-Humood, M. (undated) "The Manufacturing Sector and its Success in Attracting Indigenous Labor and Improve their Productivity: the Case of Kuwait," provided by author.

Allak, M. (1989) "The Composition and Growth of the Labor Force in Kuwait," unpublished thesis.

Al-Momen, A. (1997) "Modeling an Oil-Exporting Economy: Input-Output and Computable General Equilibrium approaches to the United Arab Emirates Economy," unpublished thesis.

Al-Moosa, A. and McLachlan, K. (1985) *Immigrant Labour in Kuwait*, Croom Helm: London.

Al-Muhanna, A. and Bahbahani, B. (1993) *Education in Kuwait from A to Z*, Al-falah: Kuwait.

Al-qabas Newspaper, 7-11-99, Kuwait

Al-Qudsi, S. and Al-Fangary, A. (1988) "The Economics of General and Higher Education: The Case of Kuwait," *The IBK Papers*, Series No. 30, December, The Industrial Bank of Kuwait, Kuwait.

Al-Quisi, I. (1996) "Population and Labor in the Kuwait Economy: The Problem and Policy," *Journal of Gulf and Arabian Prenncela Studies*, No. 82, Summer.

Alsabah, M. (1985) "General Equilibrium Analysis of Government Expenditures in an Oil Exporting Country: The Case of Kuwait," unpublished thesis, Harvard University.

Alwatan Newspaper, 7-13-98, 10-6-98, and 8-23-99, Kuwait.

Applegate, M. (1990) "A Nonlinear Multisectoral Simulation Analysis of Devaluation and Import Substitution in Zambia," *The Journal of Development Areas,* No.24, July, pp. 543-556.

Baffes, J. and Shah, A. (1998) "Productivity of Public Spending, Sectoral Allocation Choices, and Economic Growth," *Economic Development and Cultural Change*, 26 (2), January.

Bandara, J. (1991) "An Investigation of "Dutch Disease" Economics with a Miniature CGE Model," *Journal of Policy Modeling*, 14 (1), 67-92.

Bandara, J. (1991) "Computable General Equilibrium Models for Development Policy Analysis in LDCs," *Journal of Economic Surveys*, 5 (1), 3-69.

Becker, G. (1964) *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education,* NBER, New York.

Bertrand, O. (1992) "Planning Human Resources: Methods, Experiences, and Practices," UNESCO.

Birks, J.S. and Sinclair, C. (1979) "Some Aspects of the Labor Market in the Middle East with Special Reference to the Gulf States," *The Journal of Developing Areas*, Vol. 13, April, pp. 301-318.

Blaug, M. (1987) *The Economics of Education and the Education of an Economist*, New York University Press.

Blitzer, C. (1975) "Employment and Human Capital Formation," *Economy-Wide Models and Development Planning 1975* by Charles Blitzer et al., Chapter VII, World Bank.

Briggs, V. (1996) "International Migration and Labour Mobility: The Receiving Countries," *The Economics of Labor Migration*, Broeck, J. (ed.), Edward Elgar (UK).

Central Bank of Kuwait, CBK (1981) *Kuwait Economy in Ten Years.*

Central Bank of Kuwait, CBK (different issues) *Quarterly Statistical Bulletin.*

Chowdhury, A. and Kirkpatrick, C. (1994) *Development Policy and Planning: An Introduction to Models and Techniques*, Routledge, London and New York.

Decaluwe, B. and Martens, A. (1988) "CGE Modeling and Developing Economics: A Concise Empirical Survey of 73 applications to 26 Countries," *Journal of Policy Modeling*, 10 (4), 529-568.

de Melo, J.A.P. (1988) "Computable General Equilibrium Models for Trade Policy Analysis in Developing Countries: A Survey," *Journal of Policy Modeling*, 10 (4), 469-503.

de Melo, J.A.P. and Dervis, K. (1977) "Modelling the Effects of Protection in a Dynamic Framework," *Journal of Development Economics* 4, pp. 149-172.

de Melo, J.A.P. and Robinson, S. (1990) "Productivity and Externalities: Models of Export-Led Growth," Working Paper, WPS 387, Country Economics Department, The Work Bank, March.

de Melo, J. and Tarr, D. (1992) *A General Equilibrium Analysis of U.S. Foreign Trade Policy*, Cambridge MA: MIT Press.

Dervis, K. et al. (1982) *General Equilibrium Models for Development Policy*, World Bank.

Devarajan, S. et al. (1993), "External Shocks, Purchasing Power Parity, and the Equilibrium Real Exchange Rate," *The World Bank Economic Review*, 7 (1), 45-63.

Diao, X. et al. (1996) "A Dynamic CGE Model: An Application of R & D-Based Endogenous Growth Model Theory," Economic Development Center, University of Minnesota.

Dixon, P. and Parmenter, B. (1996) ""Computable General Equilibrium Modeling for Policy Analysis and Forecasting," in the *Handbook of Computational Economics Vol. I*, by Amman, H. et al., Elselvier, Amsterdam

Dixon, P. et al. (1992) "Notes and Problems in Applied General Equilibrium Economics," in the *Advanced Textbooks in Economics Vol. 32*, North-Holland, Amsterdam.

Go, D. (1994) "External Shocks, Adjustment Policies and Investment in a Developing Economy: Illustrations from a Forward-Looking CGE Model of the Philippines," *Journal of Development Economics*, 44, 229-261.

Grabel, H. and Lloyd, P. (1975) *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentialed Products*, New York: John Wiley and Sons.

Greenaway, D. et al. (1993) *Applied General Equilibrium Modeling: Applications, Limitations, and Future Development*, London: HMSO.

Haaland, J. (1991) "Modeling General Equilibrium in a Small, Open Economy: A Norwegian Example," *Journal of Policy Modeling*, 13 (4), 571-594.

Hamilton, B. et al. (1988) "Applied General Equilibrium Analysis and Perspective on Growth Performance," *Journal of Policy Modeling*, 10 (2), 281-297.

Hammar, T., Brochmann, G., Tamas, K., and Faist, T. (eds.). (1997) *International Migration, Immobility and Development: Multidisciplinary Perspectives*, Oxford: New York, Berg Publishing.

Haque, N. and Kim, S. (1995) "Human Capital Flight: Impact of Migration on Income and Growth," *IMF Staff Papers*, Vol. 42, No. 3, pp. 577-607.

Harbison, F. (1973) *Human Resources as the Wealth of Nations*, Oxford University Press, New York.

Harrison, G.W., Jones, R., Kimbell, L., and Wigle, R. (1993) "How Robust is Applied General Equilibrium Analysis?" *Journal of Policy Modeling* 15 (1), pp. 99-115.

Harrison, G.W., Rutherford, GT.F., and Tarr, D.G. (1993) "Trade Reform in the Partially Liberalized Economy of Turkey," *The World Bank Economic Review*, 7 (2), pp. 191-217.

Johnansen, L. (1974) *A Multi-Sectoral Study of Economic Growth*, second edition, North-Holland.

Jorgenson, D. and Fraumeni, B. (1992) "Investment in Education and U.S. Economic Growth," *Scandinavian Journal of Economics*, 94, Supplement, pp. 51-70.

Khorshid, M. (1990) "A Dynamic Macroeconomic Model for Kuwait: Analysis of the Medium- Term Path," *Energy Economics*, 12 (4), October, pp. 289-301.

Khouja, M.W. and Sadler, P.G. (1979) *The Economy of Kuwait – Development and Role in International Finance*, The MacMillan Press, London and Basingstoke.

Kilkenny, M. and Otto, D. (1994) " Ageneral Equilibrium Perspective on Structural Change in Rural Economy," *American journal of Agriculture Economics,* Vol. 76, No. 5, St. Paul.

Kubo, Y. et al (1984) "Multi Sector Models and the Analysis of Alternative Development Strategies: An Application to Korea," *WBSWP No. 563*, The World Bank, Washington.

KUNA (1985) Kuwait News Agency, *Efforts of Economic and Social Development in Kuwait.*

Looney, Robert. (1992) "Factors Affecting Employment in the Arabian Gulf Region, 1975-85," *International Journal of Social Economics*, 19 (2).

Looney, Robert. (1993) "Foreign Workers and the Provision of Public Services: The case of Kuwait," *International Journal of Social Economics*, 20 (1).

Lucas, R. (1988) "On The Mechanics of Economic Development," *Journal of Monetary Economics*, 22, pp. 3-42.

Mankiew, N.G., Romer, D., and Weil, D.N. (1992) "A Contribution to the Empirics of Economic Growth," *The Quarterly Journal of Economics*, May, pp. 407-437.

Mailah, M. (1996) "The Role of Expatriate Labor in Kuwait Economy Development," *The Kuwaiti Economic Journal* (2), Fall, pp. 19-46.

McMahon, W. (1998) "Education and Growth in East Asia," *Economics of Education Review*, 17 (2), April.

Ministry of Education. (1995/1996) *Educational Expenditures and Student Cost*, different issues.

Ministry of Education. *A Quantitative Development of Government Education in the State of Kuwait: From the Beginning of Education to 1993-94*, Kuwait.

Ministry of Planning, (different issues), *Annual Statistical Abstract*, Kuwait.
Ministry of Planning, (1998), *National Accounts Statistics: 1979-1995*, Kuwait.

Ministry of Planning, (1997), *A Revised Project of the Economic and Social Development Plan 1995/96-1999/2000: the General Framework,* Kuwait.

Ministry of Planning, (1990), *Statistical Abstract in 25 Years*, Kuwait.

Nicholson, Walter. (1995) *Microeconomic Theory: Basic Principles and Extensions*, 6th ed., International Edition, The Dryden Press: U.S.A.

PACI (1996) *Population and Labor Force.*

Parsell, B.F., Powell, A.A., and Wilcoxen, P.J. (1989) "The Reconciliation of Computable General Equilibrium and Macroeconomic Modelling: Grounds for Hope?" Working Paper NO. IP-44, University of Melbourne, December.

Psacharopoulos, G. (1987) *Economics of Education Research and Studies*, Part VIII and IX, pp. 305-365, Pergamon Books Ltd.

Psacharopoulos, G. (1991) *The Economic Impact of Education: Lessons for Policy Makers*, IES Press, California.

Psacharopoulos, G. (1991), "From Manpower Planning to Labour Market Analysis," *International Labour Review*, 130 (4), pp. 459-474.

Public Authority of Civil Information, PACI (different issues) *Population and Labor Force*, Kuwait.

Public Institute of Social Security, PISS, *The Institutional Manual for Social Insurance in Kuwait*, 1, pp. 1-87.

Public Institute of Social Security, PISS, *Statistical Abstract for Social Insurance,* No. 23, June 1995.

Richter, L. (1984) "Manpower Planning in Developing Countries: Changing Approaches and Emphases," *International Labor Review*, 123 (6), November-December, pp. 677-692.

Robinson, S. (1988) "Macroeconomic Structure and Computable General Equilibrium Models," *Journal of Policy Modeling*, 10 (3), pp. 353-375.

Rodrigo, G. and Thorbecke, E. (1997) "Sources of Growth: A Reconsideration and General Equilibrium Application to Indonesia," *World Development*, 25 (10), pp. 1609-1625.

Russell, S.S. and Al-Ramadhan, M.A. (1994) "Kuwait's Migration Policy since the Gulf Crisis," *International Journal Middle East Studies*, 26, pp. 569-587.

Rutherford, T.F. and Tarr, D.G. (1997) "Regional Trading Arrangements for Chile: Do the Results Differ with a Dynamic Model?" Paper presented at the Allied Social Science Meetings, New Orleans, LA, The World Bank, mimeo.

Rutherford, T.F. and Tarr D.G. (forthcoming) "Blueprints, Spillovers, and the Dynamic Gains from Trade Liberalization in a Small Open Economy," in Richard Baldwin and Joseph Francois (eds.) *Dynamic Issues in Applied Commercial Analysis*, Cambridge: Cambridge University Press.

Salah, Ahmed (1989) "A Diversification Policy Model for the Saudi Arabian Economy: CGE Model," unpublished thesis, Oklahoma State University.

Schultz,T. (1961) "Investment in Human Capital," *The American Economic Review,* Vol. LI, (1), pp.1-17.

Serra-Puche, J. (1984) "A General Equilibrium Model for the Mexican Economy," (Scarf and Shoven, eds.) in *Applied General Equilibrium Analysis*, Cambridge University Press.

Shah, N. (1995) "Structural Changes in the Receiving Country and Future Labor Migration- The Case of Kuwait," *International Migration Review,* Vol. xxix, No. 4, pp. 1000-1022.

Sirageldin, I. and Khorshid, M. (1996) 'Human Resources Development and the Structure of Oil Economies: Critical Issues with Illustration from Kuwait,' *Population and Development Transformations in the Arab World 1996*, Part II, pp. 49-78, JAI Press, Inc.

Shoven, J. and Whalley, J. (1992) *Applying General Equilibrium, Cambridge Surveys of Economic Literature*, Cambridge University Press.

Shoven, J. and Whalley, J. (1984) "Applied General Equilibrium Models of Taxation and International Trade: An Introduction and Survey," *Journal of Economic Literature*, Vol. XXII, September , 1007-1051.

Solow, R. "Technical Change and The Aggregate Production Function," *The Review of Economics and Statistics*, Vol. XXXIX, No. 1, pp. 312-320.

Tawi, S. (1989) "The Impact of Expatriate Workers on the Economy of Saudi Arabia: A Computable General Equilibrium Results," unpublished thesis, Oklahoma State University.

Taylor, L. et al. (1980), "Models of Growth and Distribution for Brazil," *The World Bank*, Oxford University Press.

U.S. Department of Labor (1987-88) "Foreign Labor Trends Report: Kuwait."

West, G. (1995) "Comparison of Input-Output, Input-Output + Econometric and Computable General Equilibrium Impact Models at Regional Level," *Economic System Research*, 7 (2), 209-227.

Weyerbrock, S. (1995) "Can the European Community Absorb More Immigrants? A General Equilibrium Analysis of the Labor Market and Macroeconomic Effects of East-West Migration in Europe," *Journal of Policy Modeling* 17 (2), pp. 85-120.

Whalley, J. (1975) "How Reliable is Partial Equilibrium Analysis?" *The Review of Economics and Statistics*, LVII (3), 299-310.

World Bank (1993) "Kuwait: A Privatization Strategy," Vol. III, Technical Cooperation Unit, Middle East & North Africa Region.

World Bank (1995) *World Development Report: Workers in an Integrating World*, Oxford University Press: USA.

APPENDIX A

EQUATIONS OF THE COMPUTABLE GENERAL

EQUILIBRIUM MODEL FOR KUWAIT

$$X_{it} = (1+\lambda_i)^{p_t} \Omega_{it} L_{1it}^{\alpha 1} L_{2it}^{\alpha 2} L_{3it}^{\alpha 3} K_{it}^{(1-\alpha 1-\alpha 2-\alpha 3)} \qquad i=1,\ldots n,\ t=1,\ldots T \qquad (1)$$

$$PN_{it} = PD_{it}(1-tau_i) - \sum_j PD_{jt}\, a_{ij} \qquad i=1,\ldots n,\ t=1,\ldots T \qquad (2)$$

$$W_{1it} = PN_{it}\,\alpha_{1i}\left(\frac{X_{it}}{L_{1it}}\right) \qquad i=1,\ldots,n,\ t=1,\ldots T \qquad (3)$$

$$W_{2it} = PN_{it}\,\alpha_{2it}\left(\frac{X_{it}}{L_{2it}}\right) \qquad i=1,\ldots,n,\ t=1,\ldots T \qquad (4)$$

$$W_{3it} = PN_{it}\,\alpha_{3i}\left(\frac{X_{it}}{L_{3it}}\right) \qquad i=1,\ldots,n,\ t=1,\ldots T \qquad (5)$$

$$NT_{st} = NKT_{st} + NFT_{st} \qquad s=1,2,3,\ t=1,\ldots T \qquad (6)$$

$$NKT_{st} = LNK_{st} + EDUG_{st} - R_{st} - DI_{st} - S_{st} + NES_{st} \qquad s=1,2,3,\ t=1,\ldots T \qquad (7)$$

$$KUG_t = \beta_0 + \beta_1\, KUG_{t-1} + \beta_2\, KUEXP_t \qquad t=1,\ldots T \qquad (8)$$

$$PAASG_t = \delta_0 + \delta_1\, PAASG_{t-1} + \delta_2\, PAASEXP_t \qquad t=1,\ldots T \qquad (9)$$

$$HSG_t = \theta_0 + \theta_1\, KPOP_{t-1} + \theta_2\, EDUEXP_t \qquad t=1,\ldots T \qquad (10)$$

$$NF_{sit} = fe_{si}\, NFT_{st} \qquad i=1,\ldots n,\ t=1,\ldots T \qquad (11)$$

$$N_{sit} = f_{si}\, NT_{st} \qquad i=1,\ldots n,\ t=1,\ldots T \qquad (12)$$

$$\sum_i^n L_{1it} = \sum_i^n N_{1it} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (13)$$

$$\sum_i^n L2it = \sum_i^n N2it \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (14)$$

$$\sum_i^n L_{3it} = \sum_i^n N_{3it} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (15)$$

$$Y_{wt} = \sum_{i=1}^n \sum_s W_{st}\, L_{ist} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (16)$$

$$Y_{kt} = \left(\sum_i PN_{it}\, X_{it} - Y_{wt} - PN_{2t}\, X_{2t} + Y_{w2t} \right)(1-t) \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (17)$$

$$Y_{gt} = Y_{kt}\, \frac{t}{(1-t)} + \sum_i^n tau_i \cdot PD_{it} \cdot X_{it} + PN_{2t} \cdot X_{2t} - Y_{w2t} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (18)$$

$$GDP_t = Y_{wt} + Y_{kt} + Y_{gt} \qquad t = 1, \ldots T \qquad (19)$$

$$TDS_t = S_p(Y_{wt} + Y_{kt}) + S_g(Y_{gt}) \qquad t = 1, \ldots T \qquad (20)$$

$$TC_{pt} = (1 - S_p)(Y_{wt} + Y_{kt}) \qquad t = 1, \ldots T \qquad (21)$$

$$C_{pit} = fcp_i \left(\frac{TC_{pt}}{PD_{it}} \right) \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (22)$$

$$TC_{gt} = (1 - S_g)(Y_{gt}) \qquad t = 1, \ldots T \qquad (23)$$

$$C_{git} = fcg_i \left(\frac{TC_{gt}}{PD_{it}} \right) \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (24)$$

$$\sum C_{it} = \sum_i C_{pit} + \sum_i C_{git} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (25)$$

$$Z_{it} = \sum_j S_{ij}\, dK_{jt} \qquad i = 1, \ldots, n \qquad (26)$$

$$U_{it} = \sum_j S_{ji} Pd_j \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (27)$$

$$M_{it} = (\mu_i / (1 - \mu_i)\, X_{it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (28)$$

$$TM_t = \sum_i M_{it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (29)$$

$$PM_{it} = PW_{it}(1 + t_{ri}) ER_t \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (30)$$

$$E_{it} = \overline{E_{it}} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (31)$$

$$PWE_{it} = \frac{PD_{it}}{((1 + tei) ER_t)} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (32)$$

$$SCT_t = -(\sum_j PW_{it}\, M_{it} - \sum_j PWE_{it}\, E_{it}) + rm\left(\sum_j \sum_s W_{st}\, NFT_{st}\right) / ER_t + NPEY_t / ER_t - (OTROW_t / Pa_t) / ER_t + NPEY_t / ER_t \qquad (33)$$

$$i = 1, \ldots, n \quad t = 1, \ldots T$$

$$ER_t = \beta_0 + \beta_1 UK_t + \beta_2 GR_t + \beta_3 JP_t \qquad t = 1, \ldots T \qquad (34)$$

$$X_{it}^d = C_{it} + Z_{it} + E_{it} \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (35)$$

$$X_{it}^d = f(PD_1, \ldots, PD_n) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (36)$$

$$X_{it}^s = f(PD_1, \ldots, PD_n) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (37)$$

$$ED_{it} = X_{it}^d - X_{it}^s = 0 \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (38)$$

$$ED_{it} = f(PD_i, \ldots, PD_n) \qquad i = 1, \ldots, n \quad t = 1, \ldots T \qquad (39)$$

$$\sum_i \Pi_i \, P_{it} = Pa_t \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (40)$$

$$dK_{it} = \frac{H_{it}\left(TDS_t + (\sum_i Pm_{it} M_{it} - \sum_i PWE_{it} \, E_{it} \, ER_t) + \sum_i CHS_{it} \right)}{U_{it}} \qquad i = 1, \quad ., n \qquad (41)$$

$$RK_{it} = (1 - \alpha_{1i} - \alpha_{2i} - \alpha_{3i}) PN_{it} \, X_{jt} (1 - t) \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (42)$$

$$RK_t = \sum_i RK_{it} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (43)$$

$$R_{it} = \left(\frac{RK_{it}}{U_{it} \cdot K_{it}} \right) + \left(\frac{U_{it} - U_{it-1}}{U_{it-1}} \right) \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (44)$$

$$SP_{it} = \frac{RK_{it}}{RK_t} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (45)$$

$$AR_t = SP_{it} \cdot r_{it} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (46)$$

$$H_{t+1} = SP_{it} + SP_{it} \cdot \frac{(R_{it} - AR_t)}{AR_t} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (47)$$

$$K_{it+1} = K_{oit} + dK_{it} - d_i \cdot K_{it} \qquad i = 1, \ldots, n \qquad t = 1, \ldots T \qquad (48)$$

Endogenous Variables	Number of Equations	Name of the Variable
X_{it}	n	Sectoral Output
PN_{it}	n	Net Prices
PD_{it}	n	Domestic Prices
W_{sit}	s.n	Wages by skill category
NT_{st}	s	Total labor supply by skills
NKT_{s}	s	Total indigenous labor supply by skills
KUG_{t}	1	Kuwait University Graduates
$PAASG_{t}$	1	PAAS Graduates
HSG_{t}	1	High School Graduate
R_{st}	s	Retired indigenous labor by skills
DI_{st}	s	Drops out from indigenous labor by skills
S_{st}	s	Graduates who continue their studies by skills
L_{sit}	s.n	Sectoral labor demand by skills
N_{sit}	s.n	Sectoral labor supply by skills
Y_{wt}	1	Disposable labor income
Y_{kt}	1	Disposable capital income
Y_{gt}	1	Government income
GDP_{t}	1	Gross Domestic Product
TDS_{t}	1	Total Domestic Saving
TC_{pt}	1	Total private consumption
C_{pit}	n	Sectoral private consumption
TC_{gt}	1	Total government consumption
C_{git}	1	Sectoral government consumption
C_{it}	n	Sectoral consumption
Z_{it}	n	Sectoral investment by sector of origin
M_{it}	n	Sectoral import

TM_t	1	Total import
PM_{it}	n	Sectoral price of import in domestic currency
PWE_{it}	n	Sectoral supply price index of domestic export
SCT_t	1	Surplus in Current Transactions
DK_{it}	n	Investment by sector of destinations
RK_{it}	n	Sectoral profit, after tax
RK_t	1	Total after tax profit
R_{it}	n	Nominal sectoral profit rates
SP_{it}	n	Sectoral shares in aggregate profits
AR_t	1	Average nominal profit rate
U_{it}	n	Sectoral price of capital
H_{it+1}	n	Sectoral shares of investment in the following period
K_{it+1}	n	Sectoral shares of capital stock in the next period
U_{it}	n	Sectoral price of capital

There are: (17 n + 5 s + 3 s.n + 15) Endogenous Variables in the model, where n = 10 and s = 3.

Exogenous Variables	Name of the Variable
$KUEXP_t$	Expenditures on Kuwait University
$PAASEXP_t$	Expenditures on PAAET
$EDUEXP_t$	Expenditures on general education
$LKPOP_t$	Kuwaiti population lagged by one year
$LKUG_t$	Kuwait University Graduates lagged for one year
$NECs_t$	Not elsewhere classified skilled labor
$NECss_t$	Not elsewhere classified semi-skilled labor
$NECun_t$	Not elsewhere classified unskilled labor
$PASSG_{t-1}$	PAAS graduates lagged for one year
E_{it}	Sectoral exports

CHS_i	Sectoral Change in stocks
PW_{it}	world price of imports
NFT_{se}	Expatriate labor by skill category
Ui_{t-1}	Price of capital lagged for one year
Pa_t	GDP deflator
dep_i	Capital depreciation by sector
OTROW	Other transfers to the rest of the world
ER_t	Kuwaiti Dinar exchange rate (KD/$)
UK_t	British Pound exchange rate (£/$)
GR_t	Deutsche Mark exchange rate (DM/$)
JP_t	Japanese Yen exchange rate (¥/$)
Parameter	Name of the Parameter
Ω_i	Shift Production parameter
λ_i	The rate of technical progress
α_1, α_2 and α_3	Output elasticities with respect to labor skills
p_t	Time periods
tr_i	Sectoral tariff rates
te_i	Sectoral export subsidy
a_{ij}	Input-Output coefficients
fe_{si}	Distributional parameter for supply of expatriate labors
f_{si}	Distributional parameter for labor supply of each skill
d_i	Depreciation rates of capital by sector
t	Direct tax rate
tau_i	Net indirect tax rates
s_p	Private average saving
s_g	Government average saving
fcp_i	Distributional parameter for private consumption

fcg_i	Distributional parameter for government consumption
S_{ij}	Capital composition matrix
H_{it}	Sectoral investment shares
rm	Proportion of expatriate workers' income remitted abroad

APPENDIX B

TABLE B-1

Input-Output Table for Kuwait (1995)
Inter-industry Transactions
(Millions of KD)

Input/Output	Agriculture	Crude Oil	Petroleum Products	Electricity and Water	Manufacturing	Construction	Trade	Transportation	Finance	Service	Total
Agriculture	70.645	0	0.374	0	0.545	0.403	53.369	5.867	0.009	0.019	131.231
Crude Oil	0.015	0.31	828.803	9.592	3.432	0.001	0.009	0	0	0.007	842.169
Petroleum Products	2.831	0.846	1.808	82.81	4.064	4.328	5.473	33.509	0.695	2.029	138.393
Electricity and Water	3.069	3.479	9.619	2.543	3.239	0.433	3.348	0.612	2.149	1.604	30.095
Manufacturing	21.911	7.93	71.456	5.466	253.794	318.012	19.036	42.138	27.132	26.484	793.359
Construction	0.237	1.114	1.744	0.244	0.235	5.872	2.618	7.242	40.262	0.703	60.271
Trade	0.639	0.802	0.403	3.285	29.257	0.522	9.624	12.795	2.612	3.799	63.738
Transportation	1.969	6.131	7.874	1.271	15.16	4.846	40.414	49.099	20.837	1.615	149.216
Finance	6.184	8.799	23.7	1.432	19.798	12.551	106.898	21.873	174.13	21.712	397.077
Service	0.681	2.275	1.547	0.862	9.232	2.622	8.935	9.953	14.717	5.112	55.936
Total	108.181	31.686	947.328	107.505	338.756	349.59	249.724	183.088	282.543	63.084	2,661.485

Source: Ministry of Planning

TABLE B-2

Input-Output Table for Kuwait (1995)
Final Demand
(Millions of KD)

Input/Output	Government Consumption	Private Consumption	Fixed Capital Formation	Change in Stocks	Export	Import	Tariff	Net Final Demand	Total Output
Agriculture	21.352	420.818	0.97	12.715	14.36	409.012	0.297	60.906	192.137
Crude Oil	0.017	0	0	-9.891	2,337.028	0	0	2,327.154	3169.323
Petroleum Products	32.338	56.131	0	21.997	1,312.948	9.293	0.276	1,413.845	1552.238
Electricity and Water	6.522	41.961	0	0	0	0	0	48.483	78.578
Manufacturing	731.063	442.219	615.944	72.436	296.172	2,274.664	67.646	-184.476	608.883
Construction	128.618	4.214	408.979	0	0	0	0	541.811	602.082
Trade	69.631	984.149	38.01	0	16	296.541	0	811.249	874.987
Transportation	32.329	276.598	2.848	0	242.88	153.831	0	400.824	550.04
Finance	96.879	577.112	33.483	0	28.325	107.229	0	628.57	1025.674
Service	1,493.687	469.193	0	0	0.287	86.193	0.018	1,876.956	1932.892
Total	2,612.436	3,272.395	1,100.234	97.257	4,248	3,336.763	68.237	7,925.322	10,586.807

Source: Ministry of Planning

TABLE B-3

Input-Output Table for Kuwait (1995)
Value Added
(Millions of KD)

Input/Output	Agriculture	Crude Oil	Petroleum Products	Electricity and Water	Manufacturing	Construction	Trade	Transportation	Finance	Service	Total
Gross Value Added	83.956	3,137.637	604.91	-28.927	270.127	252.492	625.263	366.952	743.104	1,869.808	7,928.322
Labor	31.651	102.273	80.199	35.418	112.542	147.118	224.58	193.061	122.825	1,670.95	2,720.617
Capital	40.703	2,963.416	407.918	0	115.424	73.165	364.021	63.321	526.71	54.441	4,609.119
Depreciation	15.971	71.136	99.191	121.504	35.367	21.529	33.626	87.014	79.148	146.43	710.916
Net Indirect Tax	-4.369	0.812	17.602	-185.849	6.794	10.68	3.036	23.556	14.421	-2.013	-115.33
Indirect Tax	2.956	0.812	24.288	2.756	9.306	10.68	10.586	23.556	14.421	2.605	101.966
Subsidies	7.325	0	6.686	188.605	2.512	0	7.55	0	0	4.618	217.296
Total	192.137	3,169.323	1,552.238	78.578	608.883	602.082	874.987	550.04	1,025.647	1,932.892	10,586.807

Source: Ministry of Planning

TABLE B-4

Total Labor Force (1995)

Sector	Skilled	Semi-Skilled	Unskilled
Agriculture	601	1,250	17,082
Crude Oil	1,746	4,689	1,159
Petroleum Products	2,101	6,722	2,549
Electricity and Water	1,254	5,406	544
Manufacturing	5,564	33,780	21,725
Construction	12,511	16,053	60,259
Trade	29,978	43,812	136,372
Transportation	3,841	12,521	24,515
Finance	9,899	14,740	11,547
Service	119,792	130,766	310,975

Source: PACI, Jan. 1996

TABLE B-5

Indigenous Labor Force (1995)

Sector	Skilled	Semi-Skilled	Unskilled
Agriculture	33	9	2
Crude Oil	665	2,451	385
Petroleum Products	1,101	4,012	426
Electricity and Water	340	3,077	250
Manufacturing	289	185	10
Construction	489	186	10
Trade	2,240	765	47
Transportation	1,230	3,434	376
Finance	2,244	2,451	193
Service	61,411	72,532	11,583

Source: PACI, Jan. 1996

TABLE B-6

Expatriate Labor Force (1995)

Sector	Skilled	Semi-Skilled	Unskilled
Agriculture	568	1,241	17,080
Crude Oil	1,081	2,238	774
Petroleum Products	1,000	2,710	2,123
Electricity and Water	914	2,329	294
Manufacturing	5,275	33,595	21,715
Construction	12,022	45,867	60,246
Trade	27,738	43,047	106,325
Transportation	2,605	9,087	24,139
Finance	7,655	12,289	11,354
Service	58,381	58,234	299,392

Source: PACI, Jan. 1996

TABLE B-7

Sectoral Wages (1995)

Sector	Skilled	Semi-Skilled	Unskilled
Agriculture	7123.63786	2798.29727	1397.48402
Crude Oil	26806.0612	10529.9188	5258.69548
Petroleum Products	15300.5447	6010.33816	3001.59373
Electricity and Water	10165.0355	3993.0147	1994.13206
Manufacturing	4872.9339	1914.17895	955.950792
Construction	3467.8977	1362.25463	680.316955
Trade	3299.94112	1296.27817	647.367972
Transportation	14228.3802	5589.17204	2791.26121
Finance	6840.94699	2687.25104	1342.02697
Service	7197.25119	2827.21395	1411.92516

Source: calculated from I-O table (1995), Annual Statistical Abstract, Ministry of Planning, 1997, and PACI, Jan. 1996.

TABLE B-8

Production Function Elasticity Parameters (1995)

Sector	**alpha1** ($\alpha 1$)	**alpha2** ($\alpha 2$)	**alpha3** ($\alpha 3$)	**1-($\sum_{i=1}^{3} \alpha i$)**
Agriculture	0.048472	0.039602	0.270273	0.641653
Crude Oil	0.014921	0.015740	0.001943	0.967396
Petroleum Products	0.054735	0.068791	0.013027	0.863446
Electricity and Water	0.081231	0.137560	0.006913	0.774296
Manufacturing	0.102961	0.245548	0.078866	0.572625
Construction	0.179424	0.259441	0.169533	0.391602
Trade	0.158986	0.091273	0.110670	0.639071
Transportation	0.159149	0.203794	0.199268	0.437789
Finance	0.092933	0.054359	0.021266	0.831443
Service	0.460607	0.197510	0.234570	0.107313

TABLE B-9

Production Function Parameters (1995)

Sector	Ω_i	λi
Agriculture	0.12946631	0.01
Crude Oil	0.09729849	0.01
Petroleum Products	0.32439640	0.01
Electricity and Water	0.03274434	0.01
Manufacturing	0.13858360	0.01
Construction	0.07453548	0.01
Trade	0.08305909	0.01
Transportation	0.15844168	0.01
Finance	0.14728814	0.01
Service	0.02199750	0.01

TABLE B-10

Sectoral Prices (1995)

Sector	Pd_i	Pm_i	PWE_i
Agriculture	1.0	1.0	1.0
Crude Oil	1.0	1.0	1.0
Petroleum Products	1.0	1.0	1.0
Electricity and Water	1.0	1.0	1.0
Manufacturing	1.0	1.0	1.0
Construction	1.0	1.0	1.0
Trade	1.0	1.0	1.0
Transportation	1.0	1.0	1.0
Finance	1.0	1.0	1.0
Service	1.0	1.0	1.0

TABLE B-11

Sectoral Import Tariff and Export Subsidy Rates (1995)

Sector	tr_i	te_i
Agriculture	0.0007261	0.0
Crude Oil	0.0	0.0
Petroleum Products	0.0296997	0.0
Electricity and Water	0.0	0.0
Manufacturing	0.0297389	0.0
Construction	0.0	0.0
Trade	0.0	0.0
Transportation	0.0	0.0
Finance	0.0	0.0
Service	0.0002088	0.0

TABLE B-12

Estimated Sectoral Capital and Price of Capital (1995)

Sector	**Capital**	U_i
Agriculture	564.6	1.0
Crude Oil	35446.3	1.0
Petroleum Products	4893.9	1.0
Electricity and Water	2316.3	1.0
Manufacturing	1426.8	1.0
Construction	870.2	1.0
Trade	4443.6	1.0
Transportation	949.2	1.0
Finance	6244.3	1.0
Service	899.6	1.0

APPENDIX C

```
/* A CGE model for KUWAIT using Input-Output data, 1995 (million KD)*/
/*=========================================================*/
/*=========================================================*/
New ;
/* ---------------load data and set parameter values-------------- */
               @ calculation of input-output coefficients
                 ======================================= @
@ Inter-industry transactions, million KD  @
let Xij[10,10] =
 70.645  0.0   0.374   0.0    0.545   0.403   53.369 5.867  0.009 0.019
 0.015  0.31  828.803 9.592  3.432   0.001   0.009  0.0    0.0   0.007
 2.831  0.846  1.808  82.810 4.064   4.328   5.473  33.509 0.695 2.029
 3.069  3.479  9.619  2.543  3.239   0.433   3.348  0.612  2.149 1.604
 21.911 7.930  71.456 5.466 253.794 318.012 19.036 42.138 27.132 26.484
 0.237  1.114 1.744  0.244  0.235   5.872   2.618  7.242  40.262 0.703
 0.639  0.802  0.403  3.285  29.257  0.522   9.624  12.795 2.612 3.799
 1.969  6.131  7.874  1.271  15.160  4.846   40.414 49.099 20.837 1.615
 6.184  8.799  23.700 1.432 19.798 12.551 106.898 21.873 174.130 21.712
 0.681  2.275  1.547  0.862 9.232   2.622   8.935  9.953  14.717 5.112;

@ net final demand @
let NFD[10,1] = 60.906 2327.154 1413.845 48.483 -184.476 541.811
811.249
                        400.824 628.57 1876.956;
TID=SUMC(XIJ');
@ TOTAL DOMESTIC SUPPLY @
X=TID+NFD;

@ value added - payments to factors of production plus indirect taxes @
let va[10,1] = 83.956 3137.637 604.91 -28.927 270.127 252.492 625.263
                      366.952 743.104 1869.808;

@ indirect taxes @
let indtax[10,1] = -4.369 0.812 17.602 -185.849 6.794 10.68 3.036
                           23.556 14.421 -2.013 ;

@ total expenditure @
X = sumc(Xij) + va ;

@ the "A" matrix @
A = (Xij'./X)' ;

@ LEONTIF MATRIX (LM) @
I=EYE(10);
LM=INV(I-A);

@ calculation of production function parameters @
let profits[10,1] = 40.703 2963.416 407.918 0.0001 115.424 73.165
                              364.021 63.321 526.71 54.441 ; /* million
KD */

let sub[10,1] = 7.325 0 6.686 188.605 2.512 0 7.55 0 0 4.618;
                                                  /* sectoral subsidies
*/
K = (profits+sub)./(.0837); /* capital stock equals gross sectoral
                               profits divided by rate of interest */
```

```
let dep[10,1] = 15.971 71.136 99.191 121.504 35.367 21.529 33.626
                87.014 79.148 146.43 ;  /* sectoral depreciation */
d = dep./K;     /* sectoral depreciation rates */
Ko = K;

let wrates[10,3] = 7123.63786  2798.29727  1397.48402
                   26806.0612  10529.9188  5258.69548
                   15300.5447  6010.33816  3001.59373
                   10165.0355  3993.01474  1994.13206
                   4872.93390  1914.17895  955.950792
                   3467.89770  1362.25463  680.316955
                   3299.94112  1296.27817  647.367972
                   14228.3802  5589.17204  2791.26121
                   6840.94699  2687.25104  1342.02697
                   7197.25119  2827.21395  1411.92516;

let L[10,3] = 601      1250     17082
              1746     4689     1159
              2101     6722     2549
              1254     5406      544
              5564     33780    21725
              12511    46053    60259
              29978    43812    106372
              3841     12521    24515
              9899     14740    11547
              119792   130766   310975;

Wages = wrates.*L./1000000;
O = X;

alpha = wages./(O - indtax - sumc(Xij)) ;
alpha1 = alpha[.,1];
alpha2 = alpha[.,2];
alpha3 = alpha[.,3];

Ls = L[.,1];
Lss = L[.,2];
Lun = L[.,3];

Ns = Ls;                @ sectoral labor supply of skilled labor @
Nss = Lss;              @ sectoral labor supply of semi-skilled labor @
Nun = Lun;              @ sectoral labor supply of unskilled labor @

let expats[10,1]= 568 1081 1000 914  5275 12022 27738 2605 7655  58381;
let expatss[10,1]= 1241 2238 2710 2329 33595 45867 43047 9087 12289
58234;
let expatun[10,1]= 17080 774 2123 294 21715 60249 106325 24139 11354
299392;
fes= expats./sumc(expats);
fess= expatss./sumc(expatss);
feun= expatun./sumc(expatun);
omega = O.*((Ls.^alpha1).^-1).*((Lss.^alpha2).^-1).*((Lun.^alpha3).^-1)
                    .*((K.^(1-alpha1-alpha2-alpha3)).^-1) ;
let linda[10,1]= 0.01 .01 .01 .01 .01 .01 .01 .01 .01 .01;
p=0;
```

```
@ values of exogenous variables and variables to calculate parameters @

EDUEXP=  317.993;
PAASEXP=  49.068;
KUEXP =   98.552;
LKUG= 1900;
LPAASG= 3028;
LKPOP= 671344;
NECs=4755;
NECss=2011;
NECun= -562;
NFTs=   117239;
NFTss=  210637;
NFTun=  543445;
rr= 0.0157975;          @ retirement rate @
dir= 0.000973;          @ death and illness rate @
sr1= 0.0286378;         @ post graduate study rate @
sr2= 0.0245741;         @ graduate study rate @
sr3= 0.9662874;         @ under graduate study rate @
LNKs= 63958;            @ lag of skilled Kuwaiti labor supply @
LNKss= 85609;           @ lag of semi-skilled Kuwaiti labor supply @
LNKun= 13753;           @ lag of unskilled Kuwaiti labor supply @
fls1= 0.625986;         @ skilled foreign labor share @
fls2= 0.702733;         @ semi-skilled foreign labor share @
fls3= 0.9761423;        @ unskilled foreign labor share @
PD=ONES(10,1);          @ initial domestic prices @
Pa=1;
fs = Ns./sumc(Ns) ;
fss = Nss./sumc(Nss) ;
fun = Nun./sumc(Nun) ;

           @ sectoral consumption expenditures, millions KD @
let C[10,1] = 442.17 0.017 88.469 48.483 1173.282 132.832 1053.78
308.927 673.991 1962.88 ;

           @ sectoral investment expenditures ((GFCF)), millions KD @
let Z[10,1] = 0.97 0 0 0 615.944 408.979 38.01 2.848 33.483 0 ;

           @ sectoral export demand, millions KD @
let E[10,1] = 14.36 2337.028 1312.948 0.0 296.172 0.0 16 242.88 28.325
0.287;


let  Cp[10,1] = 420.818 0 56.131 41.961 442.219 4.214 984.149 276.598
                    577.112 469.193;

let Cg[10,1] = 21.352 0.017 32.338 6.522 731.063 128.618 69.631 32.329
                   96.879 1493.687;

              @ changes in stocks, millions KD @
let CHS[10,1] = 12.715 -9.891 21.997 0 72.436 0 0 0 0  0 ;
              @ sectoral investment shares @
let H[10,1] = .006175 .101797 .035953 .167338 .048167 .015957 .034391
                  .253652 .027798 .308772 ;
              @ import demand, millions KD @
let M[10,1] = 409.012 0 9.293 0 2274.664 0 296.541 153.831
                  107.229 86.193;
```

```
let Mu[10,1]= .680384  0  .00595  0  .78884  0  .25312  .21855
                    .09465  .04269 ;

            @ sectoral tariffs, millions KD  @
let tariffs[10,1] = .297  0  .276  0  67.646  0  0  0  0  .018;

@ tariff rates @
let tr[10,1] = 0.0007261 0 0.0296997 0 0.0297389 0 0 0 0 0.0002088;

@ export subsidy rate @
let te[10,1]=0 0 0 0 0 0 0 0 0 0; @ added to current (base year) rate @

let PWbar[10,1] = 1 1 1 1 1 1 1 1 1 1; @ import world $ price indices @

@ exogenous exports, million KD, constant prices @
let Ebar[10,1] = 14.36 2337.028 1312.948 0.0 296.172 0.0 16 242.88
                                        28.325 0.287 ;
fc = C./sumc(C) ;              @ sectoral consumption shares @
fcp= Cp./sumc(Cp) ;
fcg= Cg./sumc(Cg) ;

@  Parameters  @
tau = indtax./ X ;             @ indirect tax rates @
t =  .00804859;                @ direct tax rates @
sp = .34314765;                @ private average saving rate @
sg = .11326011;                @ government average saving rate @
TIM= 26;
OTROW= 121.11;
rm= .168029;
ERo= 0.2989;                   @ base year exchange rate KD/$ @
UK = 0.6452;
GR = 1.4335;
JP = 102.83;

    @ capital composition matrix, Sij @
Sij = ones(10,10).*(EYE(10)*(Z./sumc(Z)));

@ sectoral prices of capital in previous period @
Ulag = ones(10,1)*.964;

@ matrix that reduces number of supply-demand balance equations @
let df[9,10]= 1 0 0 0 0 0 0 0 0 0
              0 1 0 0 0 0 0 0 0 0
              0 0 1 0 0 0 0 0 0 0
              0 0 0 1 0 0 0 0 0 0
              0 0 0 0 1 0 0 0 0 0
              0 0 0 0 0 1 0 0 0 0
              0 0 0 0 0 0 1 0 0 0
              0 0 0 0 0 0 0 1 0 0
              0 0 0 0 0 0 0 0 1 0 ;
```

```
/*================ the cge model ====================*/

eqsolveset;

let x0[331,1]=

 192.137 3169.323 1552.238 78.578 608.883
 602.082 874.987 550.04 1025.647 1932.892                    @ O @
.4597 .98974 .37834 1.997 .43249 .40167 .71112 .62418 .71045 .96846
                                                             @ PN @
601  1746 2101 1254 5564  12511 29978  3841  9899  119792    @ Ls @
1250  4689 6722 5406 33780 46053 43812  12521 14740 130766   @ Lss @
17082 1159 2549 544  21725 60259 106372 24515 11547 310975   @ Lun @

2584 3052 9314                                       @ KUG PAASG HSG @
1106.6 1408 210                                      @ Rs Rss Ru     @
68   87   13                                         @ DIs DIss DIun @
74   75   9000                                       @ Ss Sss Sun    @
70048  89102  13282                                  @ NKTs NKTss NKTun @
187287 299739 556727                                 @ NTs NTss NTun @

601  1746 2101 1254 5564  12511 29978  3841  9899  119792    @ Ns @
1250  4689 6722 5406 33780 46053 43812  12521 14740 130766   @ Nss @
17082 1159 2549 544  21725 60259 106372 24515 11547 310975   @ Nun @
568   1081 1000 914  5275  12022 27738  2605  7655  58381    @ NFs  @
1241  2238 2710 2329 33595 45867 43047  9087  12289 58234    @ NFss @
17080 774  2123 294  21715 60249 106325 24139 11354 299392   @ NFun @

7123.63786 26806.0612 15300.5447 10165.0355 4872.9339 3467.8977 @Ws@
3299.94112 14228.3802 6840.94699 7197.25119
2798.29727 10529.9188 6010.33816 3993.0147 1914.17895 1362.25463 @Wss@
1296.27817 5589.17204 2687.25104 2827.21395
1397.48402 5258.69548 3001.59373 1994.13206 955.950792 680.316955 @Wun@
647.367972 2791.26121 1342.02697 1411.92516

 2720  2167  2937  7925.322  2040                      @Yw Yk Yg GDP TS@
 3272.395                                                    @ TCp @
 420.818 0 56.131 41.961 442.219 4.214 984.149 276.598
  577.112 469.193                                            @ Cp @
  2612.436                                                   @ TCg @
 21.352 0.017 32.338 6.522 731.063 128.618 69.631 32.329
 96.879 1493.687                                            @ Cg @
 442.16 0.017 88.71 48.483 1173.265 132.824 1053.786
 308.97 673.993 1962.756                                    @ C @
 1  1  1  1  1  1  1  1  1  1                               @ U @
 0.97 0 0 0 615.95 408.98 38.01 2.848 33.484 0              @ Z @
 1  1  1  1  1  1  1  1  1  1                               @ PD @
 1  1  1  1  1  1  1  1  1  1                               @ pm @
 1  1  1  1  1  1  1  1  1  1                               @ PWE @
  409.012 0 9.293 0 2274.664 0 296.541 153.831 107.229 86.193  @ M @
  3336.76                                                   @ TM @
 14.36 2337.028 1312.946 0 296.15 0 16 242.937 28.324 0.287  @ E @
  1863                                                      @ SCT @
  1                                                         @ ER @
 7 112 40 184 53 18 38 279 31 340                           @ dK @
 40.703 2963.416 407.918 0.000001 115.424 73.165
  364.021 63.321 526.71 54.441                              @RKi@
```

```
 4609                                                                    @ RK @
 .1 .1 .1 .01 .1 .1 .1 .1 .1 .1                                          @ ri @
 .1 .1 .1  0 .1 .1 .1 .1 .1 .1                                           @ SPi @
 .1                                                                      @ AR @
 .1 .1 .1  0 .1 .1 .1 .1 .1 .1                                        @ Hplus1 @
564.9 35446 4894 2316 1427 871 4444 948 6244 899                      @ Kplus1 @
102  ;                                                                 @ Yw2 @

vf = zeros(rows(x0),1) ;  @ size of this vector is determined from x0 @

proc f(x) ;

        @  set-up variables of the model  @
Local
O, PN, Ls, Lss, Lun,
KUG, PAASG, HSG, Rs, Rss, Ru, DIs, DIss, DIun, Ss, Sss, Sun,
 NKTs, NKTss, NKTun,  NTs, NTss, NTun,
Ns, Nss, Nun, NFS, NFss, NFun, Ws, Wss, Wun,
Yw, Yk, Yg, GDP, TS, TCp, Cp, TCg, Cg, C, U, Z, Pd, Pm, PWE, M, TM, E,
SCT, ER, dK, RKi, RK, ri, SPi, AR, Hplus1, Kplus1, Yw2  ;

     O= x[1:10,1];        PN= x[11:20,1];
    Ls= x[21:30,1];      Lss= x[31:40,1];       Lun= x[41:50,1];
   KUG= x[51,1];       PAASG= x[52,1];         HSG= x[53,1];
    Rs= x[54,1];         Rss= x[55,1];          Ru= x[56,1];
   DIs= x[57,1];        DIss= x[58,1];        DIun= x[59,1];
    Ss= x[60,1];         Sss= x[61,1];         Sun= x[62,1];
 NKTs= x[63,1];       NKTss= x[64,1];       NKTun= x[65,1];
  NTs= x[66,1];        NTss= x[67,1];        NTun= x[68,1];
   Ns= x[69:78,1];      Nss= x[79:88,1];      Nun= x[89:98,1];
  NFs= x[99:108,1];    NFss= x[109:118,1];   NFun= x[119:128,1];
   Ws= x[129:138,1];    Wss= x[139:148,1];    Wun= x[149:158,1];
   Yw= x[159,1];         Yk= x[160,1];         Yg= x[161,1];
  GDP= x[162,1];         TS= x[163,1];        TCp= x[164,1];
   Cp= x[165:174,1];    TCg= x[175,1];         Cg= x[176:185,1];
    C= x[186:195,1];      U= x[196:205,1];      Z= x[206:215,1];
   Pd= x[216:225,1];     Pm= x[226:235,1];    PWE= x[236:245,1];
    M= x[246:255,1];     TM= x[256,1];          E= x[257:266,1];
  SCT= x[267,1];         ER= x[268,1];         dK= x[269:278,1];
  RKi= x[279:288,1];     RK= x[289,1];         ri= x[290:299,1];
  SPi= x[300:309,1];     AR= x[310,1];     Hplus1= x[311:320,1];
Kplus1= x[321:330,1];   Yw2= x[331,1];


            @  set-up equations of the model  @

/*-----------------production function-------------------------*/

vf[1:10,1] = O -
((1+linda).^p).*omega.*(Ls.^alpha1).*(Lss.^alpha2).*(Lun.^alpha3)
                        .*(K.^(1-alpha1-alpha2-alpha3)) ;

/*---------------------net prices-------------------------------*/

vf[11:20,1] = PN - (Pd -tau.*Pd - A'*Pd) ;
```

```
/*-----------------labor market equilibrium----------------------*/

vf[21:30,1] = PN.*alpha1.*O - Ls.*Ws./1000000 ;  /* skilled wages in KD
*/
vf[31:40,1] = PN.*alpha2.*O - Lss.*Wss./1000000; /*semi-skilled wages
in KD */
vf[41:50,1] = PN.*alpha3.*O - Lun.*Wun./1000000;   /* unskilled wages
in KD */

/*-----------------Labor Supply Equations-----------------------*/

                                @ Educational System's Output @
vf[51,1] = KUG - (-270.23+.4*LKUG + 21.25*KUEXP) ;
vf[52,1] = PAASG - (1128.695+.46*LPAASG + 10.81*PAASEXP) ;
vf[53,1] = HSG - (4725.322+.00153*LKPOP + 11.2*EDUEXP) ;
                                @ Retirements of Kuwaiti Labor @
vf[54,1] = Rs - rr * NKTs ;
vf[55,1] = Rss - rr * NKTss ;
vf[56,1] = Ru - rr * NKTun ;
                                @ Drops off from Labor Force @
vf[57,1] = DIs - dir * NKTs ;
vf[58,1] = DIss - dir * NKTss ;
vf[59,1] = DIun - dir * NKTun ;
                                @ Graduates Who Continue Their Studies @
vf[60,1] = Ss - sr1 * KUG ;
vf[61,1] = Sss - sr2 * PAASG ;
vf[62,1] = Sun - sr3 * HSG ;
                                @ Kuwaiti Labor Supply @
vf[63,1] = NKTs - (LNKs + KUG - Rs - DIs - Ss + NECs);
vf[64,1] = NKTss - (LNKss + PAASG - Rss - DIss - Sss + NECss);
vf[65,1] = NKTun - (LNKun + HSG - Ru - DIun - Sun + NECun);

                                @ Total Labor Supply @
vf[66,1]= NTs - (NKTs + NFTs) ;
vf[67,1]= NTss - (NKTss + NFTss) ;
vf[68,1]= NTun - (NKTun + NFTun) ;

                                @ Distribution of Total Labor Supply @
vf[69:78,1]= Ns - fs.*NTs ;
vf[79:88,1]= Nss - fss.*NTss ;
vf[89:98,1]= Nun - fun.*NTun ;

                                @ Distrbution of Foreign Labor Supply @
vf[99:108,1]= NFs - fes.*NFTs;
vf[109:118,1]= NFss - fess.*NFTss;
vf[119:128,1]= NFun - feun.*NFTun;

                                @ Equilibrium Condition @
vf[129:138,1] = Ls - Ns;
vf[139:148,1] = Lss - Nss;
vf[149:158,1] = Lun - Nun;

/*---------Income Generation and Demand for Commodities-----------*/

vf[159,1]= Yw - ((Ws'Ls+Wss'Lss+Wun'Lun)./1000000);
                          @ disposable labor income, millions KD @
```

```
vf[160,1]= Yk - (PN'O - Yw - PN[2,1]*O[2,1] +Yw2  )*(1-t);
                          @ disposable capital income, millions KD@

vf[161,1]= Yg - Yk*(t/(1-t))-tau'(Pd.*O) - PN[2,1]*O[2,1]+Yw2 ;
                               @ government income, millions KD @

vf[162,1]= GDP - (Yw + Yk + Yg);

vf[163,1]= TS - sp*(Yw + Yk) - sg*Yg ; @ total savings, million KD @

vf[164,1]= TCp - (1-sp)*(Yw+Yk);

vf[165:174,1]= Cp - fcp.*TCp./pd;

vf[175,1]= TCg - (1-sg)*(Yg);

vf[176:185,1]= Cg - fcg.*TCg./pd;

vf[186:195,1] = C -  (Cp + Cg);  @ sectoral consumption, constant
                                   prices, million KD @

vf[196:205,1]= U - Sij'*Pd ;       @ vector of capital prices @

vf[206:215,1]= Z - Sij*(H.*(TS+ Pm'*M-PWE'*E*ER - sumc(CHS))./U);
                                 @ investment by sector of origin,
                                   constant prices, million KD  @

/*-------------Product Market Equilibrium--------------------*/

vf[216:224,1]= df*(O- (A*O + C+Z+(CHS./pd)+ (E./pd) - (1+tr).*M));
                                      @ sectoral supply = demand @

/*---------------Average Price Equation-----------------------*/

vf[225,1]= (O./sumc(O))'*Pd - Pa ;  @ Price normalization equation @

/*-----------------Import Price Equations---------------------*/

vf[226:235,1] = Pm - PWbar.*(1+tr).*ER; @ import price in domestic
                                          currency @
/*------------------Export Price Equation---------------------*/

vf[236:245,1] = PWE - PD./((1+te)*ER);  @ supply price index of
                                     domestic exports, in dollars @

/*------------------Import Demand Equations-------------------*/

vf[246:255,1]= M - Mu./(1-Mu).*O; @ sectoral import, constant prices @

vf[256,1]= TM - (sumc(M));           @ total import @

/*------------------Export Demand Functions-------------------*/

 vf[257:266,1] = E - Ebar;
```

```
/*---------------Balance of Payments Equilibrium-------------*/

vf[267,1]= SCT + ( (PWbar'*(tariffs+M)-PWE'*E)+(rm*(Ws'NFs+Wss'NFss+
            Wun'NFun)./1000000)/ER-(-
2113.84+137.34*TIM)/ER+(OTROW/Pa)/ER);

/*-------------------Exchange Rate---------------------------*/

vf[268,1]= ER -(0.24205+.030167*UK+0.019917*GR+0.000086*JP)./(ERo);

/*-------------sectoral investment equations-----------------*/

vf[269:278,1]= dK - H.*(TS+Pm'*M-PWE'*E*ER-sumc(CHS))./U;
                        @ real investment by sector of destination @

vf[279:288,1]=RKi-((1-alpha1-alpha2-alpha3).*PN.*O - d.*K).*(1-t);
                                  @ after tax sectoral profits @

vf[289,1]= RK - sumc(Rki);        @ total after tax profits @

vf[290:299,1]= ri-( RKi./(U.*K)+(U-Ulag)./Ulag );  @ nominal sectoral
                           profit rates defined as returns to capital
                           valued in current prices plus capital gain @

vf[300:309,1]= SPi - RKi./RK;  @ sectoral share in aggregate profits @

vf[310,1]= AR - SPi'*ri ;             @ average nominal profit rate @

vf[311:320,1]= Hplus1-(SPi+ SPi.*(ri-AR)./AR); @ sectoral shares of
                                  investment for following time period @

vf[321:330,1]= Kplus1-(Ko + dK - d.*K);   @ sectoral capital stocks for
                                            following time period @

vf[331,1]= YW2 - (Ws[2,1]*Ls[2,1] +
Wss[2,1]*Lss[2,1]+Wun[2,1]*Lun[2,1])/1000000;

/*=================================================================*/

retp(vf) ;
endp;

__altnam = {O1, O2, O3, O4, O5, O6, O7, O8, O9, O10,
            PN1, PN2, PN3, PN4, PN5, PN6, PN7, PN8, PN9, PN10,
           "Ls1", "Ls2", "Ls3", "Ls4", "Ls5", "Ls6", "Ls7", "Ls8",
           "Ls9", "Ls10",
           "Lss1", "Lss2", "Lss3", "Lss4", "Lss5", "Lss6", "Lss7",
           "Lss8", "Lss9", "Lss10",
           "Lun1", "Lun2", "Lun3", "Lun4", "Lun5", "Lun6", "Lun7",
             "Lun8", "Lun9", "Lun10",
            KUG, PAASG, HSG, Rs, Rss, Ru, DIs, DIss, DIun, Ss, Sss, Sun,
            NKTs, NKTss, NKTun, NTs, NTss, NTun,
            Ns1, Ns2, Ns3, Ns4, Ns5, Ns6, Ns7, Ns8, Ns9, Ns10,
            Nss1, Nss2, Nss3, Nss4, Nss5, Nss6, Nss7, Nss8, Nss9, Nss10,
            Nun1, Nun2, Nun3, Nun4, Nun5, Nun6, Nun7, Nun8, Nun9, Nun10,
            NFs1, NFs2, NFs3, NFs4, NFs5, NFs6, NFs7, NFs8, NFs9, NFs10,
            NFss1, NFss2, NFss3, NFss4, NFss5, NFss6, NFss7, NFss8,
```

```
 NFss9, NFss10,
NFun1, NFun2, NFun3, NFun4, NFun5, NFun6, NFun7, NFun8,
NFun9, NFun10,
"Ws1", "Ws2", "Ws3", "Ws4", "Ws5", "Ws6", "Ws7", "Ws8",
 "Ws9", "Ws10",
"Wss1", "Wss2", "Wss3", "Wss4", "Wss5", "Wss6", "Wss7",
 "Wss8", "Wss9", "Wss10",
Wun1, Wun2, Wun3, Wun4, Wun5, Wun6, Wun7, Wun8, Wun9, Wun10,
"Yw", "Yk", "Yg",  GDP, TS,
 TCp, Cp1, Cp2, Cp3, Cp4, Cp5, Cp6, Cp7, Cp8, Cp9, Cp10,
 TCg, Cg1, Cg2, Cg3, Cg4, Cg5, Cg6, Cg7, Cg8, Cg9, Cg10,
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10,
U1, U2, U3, U4, U5, U6, U7, U8, U9, U10,
Z1, Z2, Z3, Z4, Z5, Z6, Z7, Z8, Z9, Z10,
PD1, PD2, PD3, PD4, PD5, PD6, PD7, PD8, PD9, PD10,
"Pm1", "Pm2", "Pm3", "Pm4", "Pm5", "Pm6", "Pm7", "Pm8",
"Pm9", "Pm10",
PWE1, PWE2, PWE3, PWE4, PWE5, PWE6, PWE7, PWE8, PWE9, PWE10,
 M1, M2, M3, M4, M5, M6, M7, M8, M9, M10,TM,
E1, E2, E3, E4, E5, E6, E7, E8, E9, E10,
SCT, ER, "dK1", "dK2", "dK3", "dK4", "dK5", "dK6", "dK7",
 "dK8", "dK9", "dK10",
"RKi1", "RKi2", "RKi3", "RKi4", "RKi5", "RKi6", "RKi7",
"RKi8", "RKi9", "RKi10",
RK, "ri1", "ri2", "ri3", "ri4", "ri5", "ri6", "ri7",
"ri8", "ri9", "ri10",
"SPi1", "SPi2", "SPi3", "SPi4", "SPi5", "Spi6", "SPi7",
"SPi8", "SPi9", "SPi10",
AR, "Hplus1", "Hplus2", "Hplus3", "Hplus4", "Hplus5",
"Hplus6", "Hplus7", "Hplus8", "Hplus9", "Hplus10",
"Kplus1", "Kplus2", "Kplus3", "Kplus4", "Kplus5",
"Kplus6", "Kplus7", "Kplus8", "Kplus9", "Kplus10", Yw2 } ;

__nlagr =1;
__title ="KUWAIT CGE Model, BASE RUN";
start = x0;
output file = a:eqsolve1.out reset;
{ x,tcode }  = eqSolve(&f,start);
period1 = x;
/*====================period 2=====================*/
            /*update of exogenous variables*/
H = x[311:320,1];
K = x[321:330,1];
LKUG = x[51,1];
LPAASG = x[52,1];
HSG = x[53,1];
LNKs=x[63,1];
LNKss=x[64,1];
LNKun=x[65,1];
NECs = 2294;
NECss=4310;
NECun=181;
NFTs=   125393;
NFTss= 227614;
NFTun=  596859;
LKPOP = 694356 ;
EDUEXP=  360.432;
```

```
PAASEXP=  50.353;
KUEXP =    93.878;
UK= .5889;
GR= 1.5548;
JP= 116;
TIM=27;
Pa=1.0356;
p=1;
let PWbar[10,1]= .999 1.074 1.074 1.074 .964 1.074 1.074 1.074
                              1.074 1.074;
let Ebar[10,1] = 14.5 2337.028 1312.948 0.0 296.172 0.0 16 242.88
                                        28.325 0.287 ;
_nlagr = 1 ;
__title ="KUWAIT CGE Model, Period 2";
start = x;
{ x,tcode }  = eqSolve(&f,start);

let Ebar[10,1] =  15 2566 1442 0 309 0 17 254 29 .3;
start=x;
{ x,tcode }  = eqSolve(&f,start);
period2 = x;
/*======================period 3=======================*/

            /*update of exogenous variables*/
H = x[311:320,1];
K = x[321:330,1];
LKUG = x[51,1];
LPAASG = x[52,1];
HSG = x[53,1];
LNKs=x[63,1];
LNKss=x[64,1];
LNKun=x[65,1];
NECs =7180 ;
NECss=4222;
NECun=489;
LKPOP =  732403;
EDUEXP=  388.311;
PAASEXP=  55.252;
KUEXP =   90.322;
let PWbar[10,1]= 1.08 1.134 1.134 1.134 1.01 1.134 1.134
                              1.134 1.134 1.134;
let Ebar[10,1] =  15 2660 1492  0 313 0 17 257 30 .3;
UK= .604;
GR= 1.79;
JP=  129.9;
TIM=28;
Pa=1.0424;
p=2;

output file=a:results reset;
_nlagr = 1 ;
__title ="KUWAIT CGE Model, Period 3";
start = x;
{ x,tcode }  = eqSolve(&f,start);

NFTs=    132333;
NFTss=  234499;
```

```
NFTun=  644274;
start = x;
{ x,tcode }  = eqSolve(&f,start);
period3 = x;

/*======================period 4=======================*/
            /*update of exogenous variables*/
H = x[311:320,1];
K = x[321:330,1];
LKUG = x[51,1];
LPAASG = x[52,1];
HSG = x[53,1];
LNKs=x[63,1];
LNKss=x[64,1];
LNKun=x[65,1];
NECs = 6636;
NECss=3276;
NECun=-42;
NFTs=   134132;
NFTss=  238438;
NFTun=  661170;
LKPOP = 745189;
EDUEXP =  408.19;
PAASEXP=  55.86;
KUEXP =     93.16;
let PWbar[10,1]= .937 1.277 1.277 1.277 1.03 1.277 1.277
                          1.277 1.277 1.277;
let Ebar[10,1] =  19 1699 954 0 399 0 22 327 38 .4;
UK= .60114;
GR= 1.673;
JP=115.6 ;
Pa=1.044;
p=3;
TIM=29;

output file=a:results reset;
_nlagr = 1 ;
__title ="KUWAIT CGE Model, Period 4";
start = x;
{ x,tcode }  = eqSolve(&f,start);
period4 = x;
/*============================period 5==============================*/
                     /*update of exogenous variables*/
H = x[311:320,1];
K = x[321:330,1];
LKUG = x[51,1];
LPAASG = x[52,1];
HSG = x[53,1];
LNKs=x[63,1];
LNKss=x[64,1];
LNKun=x[65,1];
NECs = 6636;
NECss=3276;
NECun=-42;
NFTs=    135956;
NFTss=  242444;
NFTun=  678509;
```

```
LKPOP = 771718;
EDUEXP=   429.1;
PAASEXP=  56.47;
KUEXP =    96.08;
let PWbar[10,1]= .891 1.434 1.343 1.343 1.05 1.434 1.343
                          1.343 1.434 1.343;
let Ebar[10,1] = 20 1964 1078 0 412 0 22 338 39 .4 ;

UK= .6002;
GR= 1.641;
JP= 126.58;
TIM=30;
Pa=1.06;
p=4;

output file=a:results reset;
_nlagr = 1 ;
__title ="KUWAIT CGE Model, Period 5";
start = x;
{ x,tcode }  = eqSolve(&f,start);
period5 = x;
/*============================period 6==============================*/
                    /*update of exogenous variables*/
H = x[311:320,1];
K = x[321:330,1];
LKUG = x[51,1];
LPAASG = x[52,1];
HSG = x[53,1];
LNKs=x[63,1];
LNKss=x[64,1];
LNKun=x[65,1];
NECs = 6636;
NECss=3276;
NECun=-42;
NFTs=   137805;
NFTss=  246517;
NFTun=  696303;
LKPOP = 799191;
EDUEXP=  451.1;
PAASEXP=  57.1;
KUEXP =    99.1;
let PWbar[10,1]=  .885 1.606 1.606 1.606 1.073 1.606 1.606
                          1.606 1.606 1.606;
let Ebar[10,1] = 21 2259 1273  0 424 0 23 348 40 .4 ;

UK= .5993;
GR= 1.610;
JP= 122.40;
TIM=31;
Pa=1.076;
p=5;

output file=a:results reset;
_nlagr = 1 ;
__title ="KUWAIT CGE Model, Period 6";
start = x;
{ x,tcode }  = eqSolve(&f,start);
```

```
period6 = x;

/*=================================================================*/
names = __altnam;

Y = names~period1~period2~period3~period4~period5~period6;

let mask[1,7] = 0 1 1 1 1 1 1;

let fmt[7,3] =
        "-*.*s "  7 7
        "*.*lf"  12 3
        "*.*lf"  12 3
        "*.*lf"  12 3
        "*.*lf"  12 3
        "*.*lf"  12 3
        "*.*lf"  12 3;

d = printfm(Y,mask,fmt);

/*=================================================================*/
```

VITA

Musaed A. Beneid

Candidate for the Degree of

Doctor of Philosophy

Thesis: A DYNAMIC COMPUTABLE GENERAL EQUILIBRIUM MODEL FOR KUWAIT WITH ENDOGENOUS HUMAN CAPITAL

Major Field: Economics

Biographical:

Personal Data: Born in Kuwait in 1964, the son of Abdulla Beneid Al-Mutairi and Hessa Fahad Al-Mutairi.

Education: Graduated from Abraq Kaitan High School in 1982; received Bachelor of Art degree in Economics from Kuwait University, Kuwait in August 1987; received Advanced Diploma in General Development Planning, the Arab Planning Institute, Kuwait in 1990; received a Master of Art degree from Vanderbilt University, Nashville, Tennessee in December 1994. Completed the requirements for the Doctor of Philosophy degree at Oklahoma State University in May, 2000.

Experience: Economic researcher, then Assistant Contracting Officer, Financial Administration at Kuwait Municipality, Kuwait, 1987 – 1990 and 1992. National Accounts Researcher, Planning Ministry, Kuwait, 1990 – 1992.