Greening Kuwait's National Accounts: Two Contrasting Methodologies And Conflicting Results

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ملخص

الحسابات القومية الكويتية المعدلة بيئيا

المحاسبة البيئية أو تعديل أنظمة الحسابات بيئيا، في الدول المتقدمة والنامية على حد سواء، تقضى بضرورة قيام تلك الدول بتعديل أنظمة حساباتها الوحدوية والقطاعية والوطنية، التى صممت وطبقت فى وقت لم يكن فيه لمـــوارد وقضايا البيئة وزن أو اعتبار، لتنتج مؤشرات وحدوية وقطاعية ووطنية معدلة بيئيا تكـــون أكثر مصداقية وموضوعية لواضع الخطط ورواسم السياسات ومتخذ القرارات علـــى كافة المستويات، وذلك بما تعكسه من استدامة حقيقية للنمو والتنمية على مســـتوى المشروع أو القطاع أو المستوى الوطني. والكويت كإحدى الدول الغنية بـــالموارد الطبيعية بحاجة ماسة للقيام بمثل هذا التعديل لأنظمة المحاسبة بها وخاصـــة نظـــام حساباتها القومية، لهذا تركز هدف البحث الرئيسى فى الإجابة على التساؤل التالى: ما مدى مصداقية النظام الحالى للحسابات القومية الكويتية، الذى يحتاج تعديله بيئيا، فى التعبير عن واقع النمو والثروة واشتقاق السياسات فى زمن العولمة؟ أو بمعنـــى آخر هل الاقتصاد الكويتى، في الفترة محل الدراسة، كان ينمو بمعدلات مســـتدامة أم أن التنمية الاقتصادية فى الكويت كانت ممولة عـــن طريـــق تســـييل مواردهـــا وأصولها البيئية دون مراعاة لحقوق الأجيال التالية في الثروة؟

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1- Introduction

Greening national accounts is the attempt to include measures of depletion and degradation of natural resources into the systems of national accounting to provide better measures for sustainable income, which will be useful for decision-making and long-term planning. To achieve this objective two steps have to be taken. The first is to account for the depreciation (depletion) of non-renewable natural resources, such as oil and gas. The second is to account for the depletion and degradation of renewable natural resources such as air and water pollution and soil erosion, to estimate the pollution costs which could be considered as a minimum social value of capital consumption allowance for these environmental assets. This paper focuses on the first problem, i.e. accounting for the depletion of non-renewable natural resources.

The rationale for including depletion of non-renewable natural resources in national income measures depends on the recognition that such resources are capital. It does not depend on whether produced capital can be substituted for natural resources. There is an extensive substitution among different types of produced capital, but net domestic product still accounts for annual changes in the value of the entire produced capital stock. Similarly, even if there is extensive substitution of produced capital for exhaustible resources, income measures should still account for annual changes in the value of the entire stock of produced and environmental capital. The real annual change in the capital stock can be determined if the depletion of natural resource capital is accounted for in national income accounts as is currently done for produced capital when calculating Net Domestic Product (NDP).

In Kuwait non-renewable natural resources, such as oil and gas, are of concern because they constitute an important part of

the country's capital stock and their use can promote Kuwait sustainable development if some of the returns from extraction are used for investment in produced capital (machines, buildings) rather than consumption. However, in Kuwait national accounts, as in most countries, there are no entries for the value of depletion and new discoveries for oil and gas corresponding to those for gross investment and depreciation of produced capital. Thus the current national accounts, while useful for short to medium-term demand management and stabilization policies, may mislead policy makers interested in long-term planning. In this sense the paper argues that Kuwaiti income is inflated by the depletion of exhaustible resources. Such inflated income measures may encourage high levels of current consumption that may be hard to sustain in the future.

There are two main approaches for determining depletion allowances for non-renewable natural resources: the depreciation and the user-cost approaches. The depreciation approach is analogous to the treatment of produced capital depreciation. The user-cost approach divides the net receipts from the depletable resource into income and user-cost percentages. These percentages are chosen by determining the perpetuity value of the present value of the finite stream of net receipts from the depletable resource extraction. This paper uses both approaches to determine the value of annual depletion of oil and gas in Kuwait over the 1970-1997 period, though of course this accounts for only one aspect of a more complete environmental accounting exercise that would consider all environmental costs (including those associated with the depletion of non-renewable resources).

Therefore, the rest of this paper is divided into five sections: the second gives a brief comparison and provides the conceptual basis for the main approaches, depreciation and user

cost approaches, that are used in estimating non renewable natural resources depletion; the third gives an overview for Kuwait's petroleum industry; the fourth applies both approaches to Kuwait's macro accounting indicators to construct an environmentally-adjusted measures which include and accounts for the depletion of natural capital; the fifth presents the policy implications and finally section six presents the conclusions.

2- Measuring Depreciation For Non-Renewable Resources

Despite widespread agreement of the need to address natural capital depletion within the System of National Accounts, there is no consensus regarding means to accomplish this task. Two of the leading natural resource accounting methodologies approaches this issue in strikingly dissimilar manners(1).

2-1 Depreciation Approach

The Depreciation Approach utilises economic techniques similar to those used to value the decline in productivity of fixed capital in valuing natural capital depreciation. Standard calculations of national income impute and subtract fixed capital depreciation from gross domestic product (GDP) to arrive at NDP; similarly, the economic value of natural capital depletion is subtracted from NDP in estimating Environmentally-adjusted net Domestic Product (EDP).

In order to calculate natural capital depreciation, physical accounts must be created. Changes in capital stocks are recorded in physical units appropriate to the particular resource. As geological and ecological information on changes in natural capital stocks comes in physical units, such data must value each unit at its net price, namely, its real value as an input in the production process minus the average cost incurred (including a

normal profit) in extracting the resource. Net changes in the value of stocks are attributed to current year additions (such as reproduction) minus deductions (such as depletion) plus any price changes of the resource during the year.

Therefore, according to depreciation approach, two models for measuring natural capital depreciation δ_N have emerged in the more practically orientated literature. The first model is net price I δ_{NPI} uses average cost, C, instead of marginal cost to compute rent, which is taken as the measure of depreciation, so that:

$$\delta_{NPI} = (P - C)^* (R - N) \qquad (1)$$

Note that marginal cost is less than average cost[2], $c > C$, therefore $(P - C) > (P - c)$ so that on this account there would arise an overestimation of THR[3] using Equation (1). The second model of depreciation approach is net price I, δ_{NPI}, that have appeared ignored N, presumably on account of lack of reliable data or to avoid the fluctuations and swings resulted from ambiguity surrounding R & N measures. Therefore, the second model of depreciation approach, net price II, δ_{NPII} is presented in equation (2) below.

$$\delta_{NPII} = (P - C)^* (R) \qquad (2)$$

2-2 User Cost Approach

In contrast, the User Cost approach or El Serafy approach, that takes its name from its originator, divides the net revenues from the sale of an exhaustible resource into a capital element, or user cost, and a value-added element, which represents true income. The user cost represents the erosion of capital and

indicates the portion of revenues which must be reinvested in other capital such that the total return, both from the new investments and from the portion of current extraction which may be reckoned as income, would produce a stream of income to compensate for the eventual decline in receipts from the asset. According to this model:

$$\delta_{UC} = R\,(P\text{-}C) - X = R\,(P - C) / (1 + r)^{n+1} \qquad (3)$$

Where X is the indefinitely sustainable income from extraction, r is the interest rate; n is the deposit or resource lifetime assuming a constant rate of extraction.

With respect to stocks of non-renewable resources, the magnitude of the user cost varies inversely with the reserve-to-extraction ratio. The user cost approach is flexible in handling changing levels of extraction or alterations in reserve estimates. The rate of depletion, denoted by n indicates the reserve-to extraction ratio (that is, the life expectancy of the reserve measured in years at the current period's extraction rate). Declining reserves cause n to shrink and the user cost to increase, while new discoveries cause n to increase and the user cost to decrease, ceteris paribus. The User Cost Method does not place a value upon new reserves; rather, it adjusts the reserve-to-extraction ratio to indicate the increased life expectancy of the reserve.

Finally, one can mention that the first model of depreciation approach, net price I (NPII)[4], is liable to produce a fluctuated numbers in estimated natural capital depletion ($\delta_{N,}$) and therefore this model is not recommended in the guidelines for environmental accounting that have emerged from

deliberations involving national and international statistical agencies. However, those guidelines recommended the second model of depreciation approach, net price II (NPI) and user cost models (UC), which they are quite widely been used, even in illustrative applications of those guidelines(5).

3- Petroleum Industry In Kuwait's Economy

This section addresses the question of how to measure the dependence of oil or mineral producers, such as Kuwait, upon their production of "wasting assets." This question is much more real since 1982 after OPEC (the Organization of the Petroleum Exporting Countries) oil revenues peaked, and the issue of growth in the Middle East without growing oil revenues is now a practical reality, rather than a hypothetical contingency.

Economic expansion in the Middle East has indeed been phenomenal since the mid- 1960s. This has been observed both in the oil-rentier states themselves and also in the "rentiers by proxy"- the economies like Jordan or North Yemen or Egypt which derived their prosperity from oil-financed aid or workers' remittances. This expansion, however, is fragile, and the oil exporters are much more vulnerable to perturbations in oil revenues than is suggested by the ostensible rapid growth in the non-oil sectors, in the case of Kuwait, there has been little genuinely non-oil growth of the traditional non-oil sectors. Sustainable GDP or "non-depletable" GDP measures the product originating in reproducible factors of production, i.e., the "income" net of the economic rent or scarcity rent attributable to the finiteness of the mineral resource. For countries, such as Kuwait, where mineral rents loom large, the adjusted GDP or "non-depletable" income provides a more accurate measure of the sustainable income and thus to the countries' vulnerability to changes in mineral or oil revenues.

The utility of measuring sustainable GDP or gross national product (GNP) is several-fold. First, the "quality of growth" highlights the distinction between "expansion" and "growth", which must be made in assessing performance of resource-based economies. A mineral-exporting economy, such as Kuwait, can expand by liquidating its geological capital at an increasing rate, yet this is clearly different from an identical "growth" rate derived from investment in plant and equipment. The difference is both qualitatively and quantitatively significant. Second, inter-country comparisons of national income are better since some fraction of the "income" of mineral exporters is the draw down of a capital asset. For example, the incomes of two countries, where one is based upon renewable resources and the other upon depletion of a finite stock of minerals, are not really commensurate. Thus, part of the foreign aid from Kuwait could be looked at as capital transfers rather than grants out of income. Third is the measurement of "transformation', which is an indispensable adjustment if one is to measure the success of mineral exporters, such as Kuwait, in "transforming" their economies through investment of their mineral rents. The unadjusted GDP of a mineral exporter does not provide the appropriate information to planners, since "income" is overstated and the success of domestic programs is overstated.

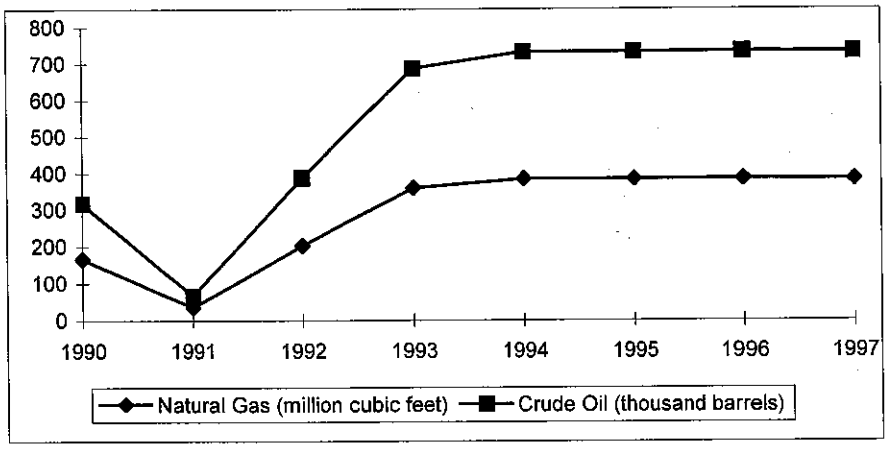
In addition, the productivity of domestic capital formation is also biases upwards, because mineral rents and factor incomes are commingled and much of the ostensible return to capital is actually mineral rents. "Non-depletable" income is the more appropriate metric for real economic development and diversification away from oil[6]. The depletion effect exists in all economies where depletable resources are extracted, but it is significant only for those mineral-producing countries, which meet two criteria: (1) the share of economic rent in the mineral's

price is high and (2) mineral exports are a large share of total GDP. Both criteria must be satisfied; otherwise, the effect, while theoretically present, is de minimise and can be ignored.

Mineral production, particularly oil production, generates significant economic rents, and the depletion adjustment is commensurately important for such countries. Kuwait is the one of the most important cases of such rents do involve minerals, of which oil is currently the most interesting example, and the subsequent discussion is confined to oil although in principle it applies to any other mineral as well. Oil is doubly important as (1) oil exports are by far the largest component of world trade and (2) rents constitute a high fraction of the market price of oil. For example, the export price of crude oil (mid-1985) is some $28 per barrels; in most of the Middle East exporting countries, but the total production cost is estimated to be about two dollars. Scarcity or monopoly rents thus make up some 95 percent or more of the total price of crude oil.

The mining industry in Kuwait is dominated by the extraction of crude oil. Kuwait's reserves are high by Middle Eastern and world standards; they amounted to about 96.5 billion barrels at the end of 1997, or about 10% percent of total world reserves. (USDE, 1998). Production of crude oil has risen significantly in the past decade, rising from an average of 318,000 thousand barrel per day (b/d) in 1990 to 723.574 b/d at the end of 1997 (see Figure 1; Table 6 in Appendix.)[7]. Natural gas output has shown an even more increase, reaching 383.869 million cubic feet at the end of 1997 compared to only 166.632 million cubic feet in 1990. At 1997 production levels, Kuwait had enough petroleum to last another 131 years.

Figure 1: Production of Crude Oil and Natural Gas



The oil and gas industry is the most important sectors of Kuwait economy. Over the 1970-1997 period, the share of oil and gas extraction in Kuwait real GDP was 61% in 1970, 66% in 1980, 39% in 1990 and 40% in 1997, with an average share of 50% over the study period (MOP, 1998 and 1999). The growth of oil exports is constrained by the continuing increase in world oil consumption, however, and by the persistent weakness of international oil prices, which was the case in the last few years. Between the 1987 and 1993 years, the value of petroleum exports fluctuated between 81% and 96% of total exports, representing on average 92% per cent of total export revenues for 1970-1997 period (MOP, 1999).

The impact of oil rents upon Kuwait's macro-economy is very high. It is dominating total export receipts, the GDP and government revenues. Table 1 and Figure 2 show that oil revenues constitutes from 11to 96 percent of total export earnings for the entire period, while the share of government expenditures as percentage of oil revenues ranges between 9 percent for 1974 to 88 percent for 1994. The oil sector itself

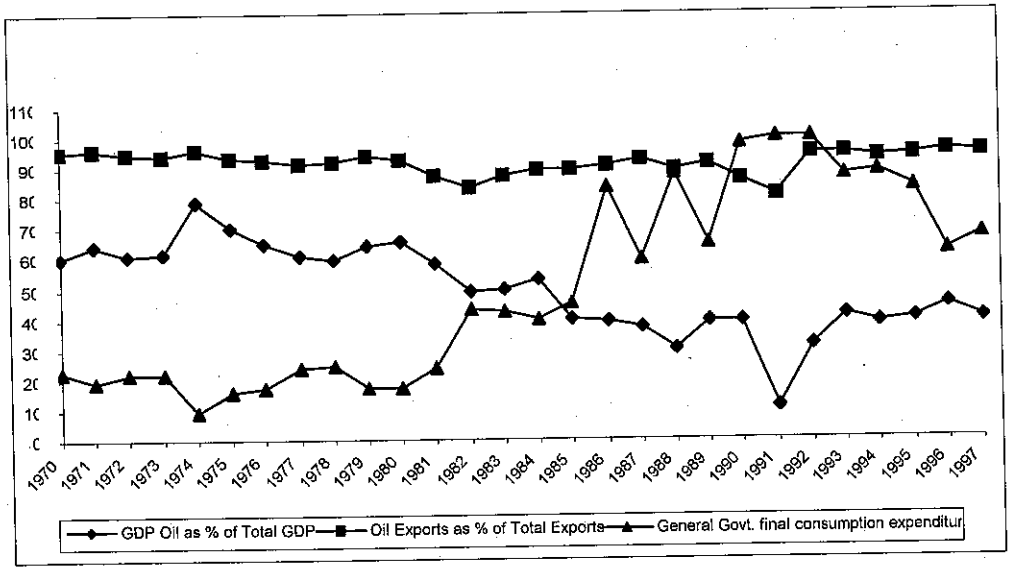
comprises between 79 percent of GDP in 1974 to 11percent in 1991.

Table 1: Oil Dependence Indicators (in percent)

Year	GDP Oil as % of Total GDP	Oil Exports as % of Total Exports	General Govt. final consumption expenditure (%)
1970	61	96	23
1971	64	96	19
1972	61	95	22
1973	61	94	22
1974	79	96	9
1975	71	94	16
1976	65	93	17
1977	61	92	24
1978	59	92	24
1979	65	94	17
1980	66	93	17
1981	59	88	24
1982	49	84	43
1983	50	87	43
1984	53	90	40
1985	40	89	45
1986	39	91	84
1987	37	93	59
1988	30	89	88
1989	39	92	65
1990	39	86	98
1991	11	81	1879.16 (*)
1992	31	95	179.78
1993	41	95	88
1994	38	93	88
1995	40	94	83
1996	44	95	62
1997	40	95	67
Average	**50%**	**92**	**50**

*) The government expenditures in 1991 and 1992 were very high compared to the rest of the study years. This means that the high bill government of Kuwait had to pay necessary for reconstructing the infrastructure of the economy, which has been destroyed by Iraq invasion in 1991.

Figure 2: Oil Dependence Indicators (in percent)



While the importance of oil is recognised, in case of Kuwait, there is no established precedent for recognizing depletion in the measurement of income. Present conventions for national income accounting do not provide for a depletion adjustment; indeed, it is specifically excluded in the United Nations guidelines for national accounts. This is paradoxical, since provision is made for the consumption of a reproducible asset but not for the drawdown of the irreproducible assets, i.e. exhaustible resources.

4- Results For Kuwait

In this section we present some results for Kuwait. The main source is the national income accounts, which can be used to derive an estimate of depreciation of non-renewable resources (i.e., oil and gas). These depreciation estimates are based on an

estimate of the rent that is been earned in oil and gas sector. The issues of Kuwait's National Accounts (NA) have been used for the period 1970-1997, to calculate the total rent for oil and gas sector in applying depreciation and user cost approaches.

Two principle approaches have been proposed for incorporating the depletion of (non-renewable) resources as a cost into production accounts. El-Serafy (1989) has proposed a "user cost" to distinguish between the true (that is, sustainable) income component of the sales revenues of minerals and its capital component, which is to be deducted from the gross production value as a user cost. In contrast Repetto and his colleagues (1989) have applied a "depreciation" approach. Gross value added is not affected by this method, in that the consumption and increase of natural resources are treated along the line of produced capital. This makes it possible to obtain a further modified (in addition to the depreciation of produced fixed assets) net value added of oil and gas sector.

It has to be mentioned that, there are two ways to deal with increase in mineral reserves. On one hand, the discoveries, extensions, and up grade of the resource could be recorded as (own-account) capital accumulation, thus affecting net domestic product. On the other hand, such capital increases have generally been accounted for outside the production accounts (use/value-added accounts) under other volume changes in the balance sheets. This is to avoid the volatility of national aggregates when including new discoveries in flow accounts. Therefore, SNA 93 and its satellite accounts have reported results on this basis for Mexico and Papua New Guinea. (1993). Another view for excluding discoveries from the production accounts is that the increase in natural capital is not the result of economic production, and accounting for its discovery as economic production would open up the economic system to non economic

process of natural growth and accumulation (as well as destructive natural events) (UN, 1993).

4-1- Depreciation Approach

This study applies the current net price method, rather than present value calculations for the previous mention reasons, to determine the depletion allowance when applying the depreciation approach. The two versions of net price however, have been calculated, the one proposed by United Nations in SNA 93 and the other which is proposed by Landefeld and Hines (1985) and applied by Repetto (1989) in case of Indonesia.

Both calculations of depletion allowance measures for depreciation and user cost approaches, in Table 2 and Figure 3 have a significant effect on sectoral and macro aggregates of Kuwait's economy that could be explained as follows. For depreciation approach and NPI estimates Table 2 shows that, after the deduction of the depletion allowance, the (adjusted) value added of oil and gas sector ranges from 4 to 7 percent of the original value for 1970-97 period. As a consequence, total net domestic product reduced by approximately 6 and 48 percent for the same period. The annual depletion rate of natural resources (oil), compared with the depreciation of produced capital, is significant for the entire 28 years period. The depletion allowance of natural capital was more than double of the depreciation of produced capital. Clearly, this conveys a different picture of overall capital or investment efficiencies in the oil and gas sector in comparison with one conveyed by conventional capital-output ratios.

4-2- User Cost Approach[8]

On the other hand, the results of the user cost analysis are presented in Table (2) and Figure (3). The user cost 4 % depletion allowance was KD 1.643 million in the 1992 and KD

502.826million in 1972, which GDP by 0.1 and 6 Percentage points. On the other hand, The user cost 2 % depletion allowance was KD 23.918 million in the 1991 and KD 1437 million in 1972, which GDP b by 1.0 and 18 Percentage points.

The factors that account for the fluctuation of the user-cost adjustments over the years (apart from price changes) were new discoveries. For current oil and gas resources, discoveries extend their expected life span, therefore, the amount that has to be retained for the development of alternative income sources decreases. This phenomenon is responsible for the reduction in the user cost in 1980 as opposed to 1986, for example. The large differences in the adjustments between the years are mainly a result of the price changes of oil and gas in the world markets. For example, the fall in oil prices in 1986.

4.3. Kuwait's Environmentally-adjusted Indicators

Table (2) and Figure (3) show four alternative measures for Kuwait's net domestic product adjusted for oil depletion. The users cost adjusted measures for 2 and 4 percent are called EDP (UC 2%) and EDP (UC 4%), respectively. The adjustments for user cost and depreciation approach were made at GDP level. The depreciation-adjusted measures for net price I and net price II are called EDP (NPI) and EDP (NPII) respectively.

From Table 2 it can be seen that EDP (NPII), the largest alternative measure, is higher than GDP by an average of 119.33 percent over the 1970-1997 period. The average was high due to the significant additions to oil and gas reserves in 1970s and 1980s. EDP (NPII) is greater than GDP from 1978 to 1985 when the net change in oil and gas reserves was positive. On the other hand, EDP (NPI), the lowest alternative measure, is significantly lower than GDP by an average of 40.45 percent over the 1970-1997 period. EDP (NPI) is lower than GDP for the entire period

because additions to reserves have been recorded in the balance sheets as other volume changes which means that the total rent of the natural resource is subtracted from GDP, (see Table 7 in Appendix).

Figure 3: Environmentally adjusted measures of net domestic product, 1970-1997

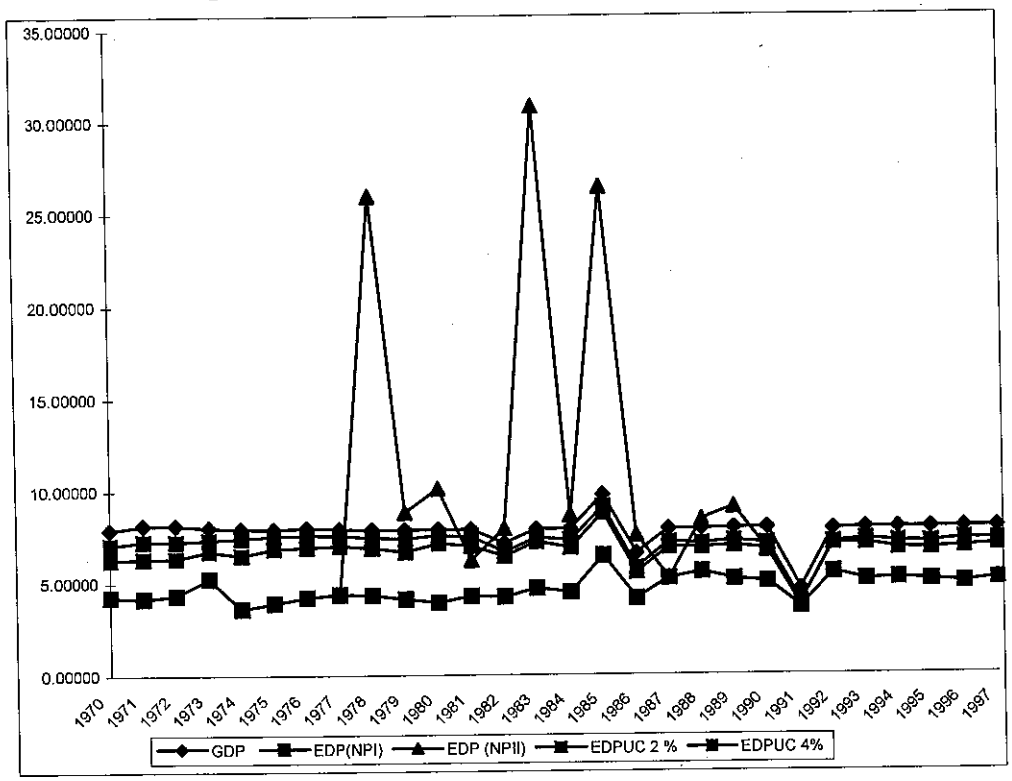


Table 2: Environmentally adjusted measures for Kuwait's net domestic product, 1970-1997 (KD billion 1995).

Year	GDP	EDP(NPI)	EDP (NPII)	EDPUC 2 %	EDPUC 4%
1970	7.89136	4.23927	4.23927	6.26000	7.06338
1971	8.12703	4.16673	4.16673	6.32727	7.26407
1972	8.12813	4.33075	4.33075	6.34137	7.24612
1973	8.01528	5.22384	5.22384	6.73597	7.34580
1974	7.94109	3.60322	3.60322	6.51767	7.44297
1975	7.91959	3.90028	3.90028	6.86450	7.54399
1976	7.99269	4.23727	4.23727	6.94557	7.60172
1977	7.94432	4.38366	4.38366	7.02846	7.57448
1978	7.89689	4.33899	25.97454	6.90334	7.45724
1979	7.88770	4.13294	8.83399	6.67639	7.40685
1980	7.91363	3.93129	10.13462	7.15513	7.58729
1981	7.90875	4.29060	6.23100	6.99207	7.48895
1982	7.14284	4.22970	7.94962	6.44915	6.68527
1983	7.90057	4.67555	195.83912	7.21435	7.43092
1984	7.93157	4.46634	8.64584	6.88086	7.32497
1985	9.77264	6.45626	26.43849	8.78657	9.13611
1986	6.58583	4.12260	7.57723	5.54217	5.79798
1987	7.89029	5.21335	5.21335	6.88239	7.17707
1988	7.90853	5.56643	8.43403	6.89650	7.11292
1989	7.93631	5.16924	9.09691	6.98100	7.25834
1990	7.95185	5.00049	6.71320	6.78722	7.10267
1991	4.60413	3.63036	3.63036	3.84865	3.87052
1992	7.87360	5.52384	5.52384	7.09572	7.14824
1993	7.94569	5.10825	5.10825	7.07859	7.29682
1994	7.93522	5.18502	5.18502	6.80635	7.16525
1995	7.92532	5.07327	5.07327	6.78208	7.13762
1996	7.95090	4.94360	4.94360	6.87794	7.28880
1997	7.94707	5.14921	5.14921	6.95772	7.27702
Average	**7.81317**	**4.65330**	**14.13502**	**6.73625**	**7.18691**
VAR	**0.6149414**	**0.439169**	**1299.757**	**0.583247**	**0.668453**
COV	**12.705557**	**10.5957**	**0.010875**	**11.54956**	**10.75155**

EDP (UC2%) and EDP (UC4%) are lower than GDP by an average of 13.82 and 8.06 percent, respectively, over the 1970-1997 period. Both the users cost are significantly lower than EDP (NPII) for two reasons. First, in user cost approach additions to reserves mean a smaller subtraction from GDP, while EDP (NPII) is greater than GDP in the years when additions are greater than extraction. Second, in estimating the net price per unit the natural resource component has to be calculated first, which was the result of subtracting the value of produced capital from the total value of reserves. Therefore, increases in produced capital stock and unprofitable years in oil and gas industry may reduce the residual natural resource value (depletion allowance). In contrast, the user cost and incomes' portions of oil and gas operating surplus are jointly determined. Thus, the reduction in natural resource value when measuring EDP (NPII) may be greater than the user cost in entry when estimating EDP (UC2%) and EDP (UC4%). However, EDP (UC4%) is higher than EDP (UC2%) by an average of 6.68 percent over 1970-97 period. This is because the users cost portion of oil varies inversely with the discount rate. The average of user cost percentage for EDP (UC4%) is 46.87 percent compared to 41.2 percent for EDP (UC2%) see Table 2. Hence EDP (UC4%) is always higher than EDP (UC2%).

Table (3) and Figure (4) shows the annual percentage change for each alternative of environmentally adjusted net domestic product (EDP). From Table 3 the average growth rate of GDP was 1.6% compared to 2.4% for EDP (UC2%), 2.2% for EDP (UC4%), 2.4% for EDP (NPI), and 108.8% for EDP (NPII). However, as can be seen from Table 2 and Figure 2, the annual changes in growth rate for the adjusted measures are more important for policy analysis than the total average for the entire period. EDP (NPII) has shown the highest average growth rate

resulted from the volatility of new discoveries for oil reserves during the study period. EDP (NPII) has shown, as well, the highest variance and coefficient of variation, 1229.757 and 91.932, compared to 0.583, 0.085 for EDP (UC2%), 0.66, 0.093 for EDP (UC4%), and 0.439, 0.093 for EDP (NPI). For example, EDP (NPII) growth rate in 1984 was –95.6%, when reserves started to decline after noticeable increase in discoveries of oil from 1978 to 1983. On the other hand, all other measures have shown a stable average growth rate, except for 1991 the year of Iraq Invation to Kuwait, because they are not tied directly to changes in physical reserves.

Figure 4: Annual percent change in real Kuwait's Net Domestic Product, 1970-1997 (KD billion 1995).

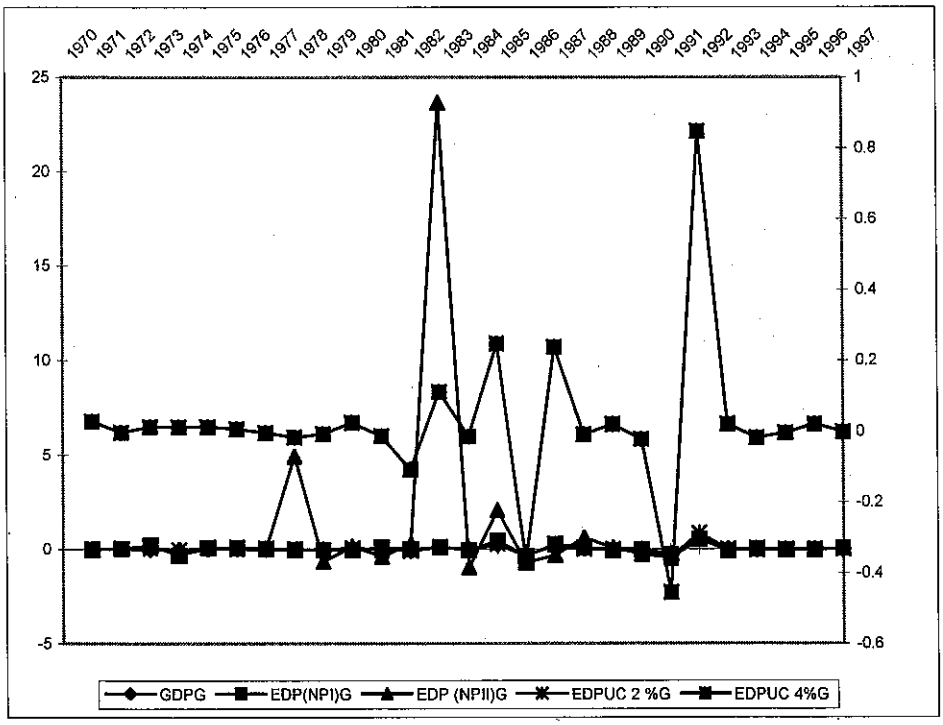


Table 3: Annual percent change in real Kuwait's Net Domestic Product, 1970-1997 (KD billion 1995).

Year	GDPG (%)	EDP(NPI) G (%)	EDP (NPII) G (%)	EDPUC 2 %G	EDPUC 4%G	EDPUC 3%G
1971	3.0	-1.7	-1.7	1.1	2.8	2.1
1972	0.0	3.9	3.9	0.2	-0.2	-0.1
1973	-1.4	20.6	20.6	6.2	1.4	3.3
1974	-0.9	-31.0	-31.0	-3.2	1.3	0.0
1975	-0.3	8.2	8.2	5.3	1.4	3.0
1976	0.9	8.6	8.6	1.2	0.8	0.8
1977	-0.6	3.5	3.5	1.2	-0.4	0.2
1978	-0.6	-1.0	492.5	-1.8	-1.5	-1.7
1979	-0.1	-4.7	-66.0	-3.3	-0.7	-1.8
1980	0.3	-4.9	14.7	7.2	2.4	4.5
1981	-0.1	9.1	-38.5	-2.3	-1.3	-1.8
1982	-9.7	-1.4	27.6	-7.8	-10.7	-9.7
1983	10.6	10.5	2363.5	11.9	11.2	11.4
1984	0.4	-4.5	-95.6	-4.6	-1.4	-2.6
1985	23.2	44.6	205.8	27.7	24.7	25.7
1986	-32.6	-36.1	-71.3	-36.9	-36.5	-36.7
1987	19.8	26.5	-31.2	24.2	23.8	23.9
1988	0.2	6.8	61.8	0.2	-0.9	-0.6
1989	0.4	-7.1	7.9	1.2	2.0	1.8
1990	0.2	-3.3	-26.2	-2.8	-2.1	-2.4
1991	-42.1	-27.4	-45.9	-43.3	-45.5	-44.9
1992	71.0	52.2	52.2	84.4	84.7	84.7
1993	0.9	-7.5	-7.5	-0.2	2.1	1.4
1994	-0.1	1.5	1.5	-3.8	-1.8	-2.6
1995	-0.1	-2.2	-2.2	-0.4	-0.4	-0.3
1996	0.3	-2.6	-2.6	1.4	2.1	1.9
1997	0.0	4.2	4.2	1.2	-0.2	0.3
Average	**1.6**	**2.4**	**105.8**	**2.4**	**2.1**	**2.2**

5- Policy Implications

Environmental accounting is used in this study to construct modified national income indicators, which incorporate the cost

of oil and gas depletion. The depletion of oil and gas assets as calculated above would normally be subtracted from GDP, for user cost approach, to arrive at oil adjusted GDP. However, for the purpose of comparison, depletion adjustments for user cost and NPI have been made relative to NDP, the value that is reportedly income from the oil and gas sector. Both of the resource accounting methodologies suggest that, when resource depletion costs are incorporated, the Kuwait's oil sector has always produced lower incomes. The above calculations as well as the depletion allowance for depreciation and user cost approaches have shown a significant effect on sectoral and macro aggregates of Kuwait's economy. This could be explained as follows: First, for depreciation approach (4%) and NPI estimates, as shown in Table 4 and Figure 5, the adjusted value added of oil and gas sector as percentage ranges from 10 to 68 percent of the original value for 1970-97 period. As a consequence, total net domestic product is reduced by 11 to 0.71 percent for the same period. The main factor that accounts for the fluctuation of the user-cost adjustments over the years was new discoveries. Discoveries extend the resource expected life span and therefore, the amount that has to be retained for the development of alternative income sources decreases.

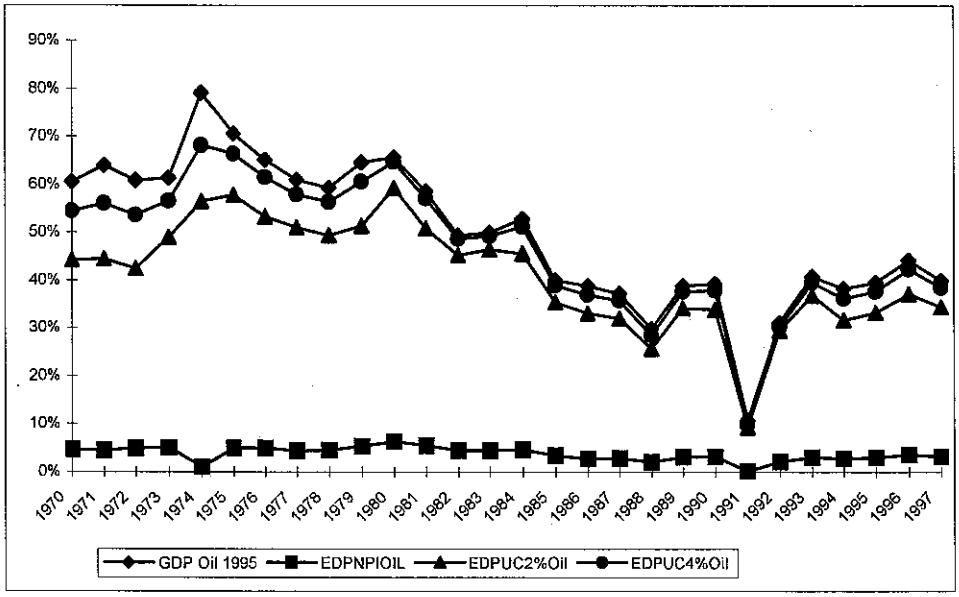
The magnitude of oil depletion adjustments calculated using depreciation approach were generally larger than the comparable Figures produced following the user cost approach (see Fig. 6.5). Resource depletion adjustments have indicated that the failure to account for the cost of depletion in standard measures of GDP has led to consistently overstated levels of national income in Kuwait. For example, following user cost approach, GDP adjustments for oil and gas between 1970 and 1997 yielded an average annual income that was 2.83 percent lower than the Figures derived by standard calculations. On the

other hand, the depreciation approach called for average downward adjustments of 46 percent of the standard GDP (see Table 4).

Table 4: Environmentally-adjusted measures as % of GDP): User Cost (2 and 4%) and depreciation (NPI) approaches (KD 1995.

Year	GDP Oil 1995	EDPNPIOIL	EDPUC2%Oil	EDPUC4%Oil
1970	60.52%	4.70%	44%	54%
1971	64.00%	4.45%	44%	56%
1972	60.88%	4.96%	42%	54%
1973	61.32%	5.00%	49%	57%
1974	79.07%	1.07%	56%	68%
1975	70.55%	4.93%	58%	66%
1976	65.12%	4.94%	53%	61%
1977	61.00%	4.45%	51%	58%
1978	59.32%	4.53%	49%	56%
1979	64.61%	5.32%	51%	61%
1980	65.68%	6.30%	59%	65%
1981	58.58%	5.48%	51%	57%
1982	49.34%	4.48%	45%	49%
1983	49.92%	4.47%	46%	49%
1984	52.83%	4.65%	46%	51%
1985	40.05%	3.40%	35%	39%
1986	38.84%	2.73%	33%	37%
1987	37.24%	2.89%	32%	36%
1988	29.82%	2.08%	26%	28%
1989	38.88%	3.17%	34%	38%
1990	39.30%	3.20%	34%	38%
1991	10.71%	0.15%	9%	10%
1992	31.10%	2.17%	30%	30%
1993	40.85%	3.10%	37%	40%
1994	38.30%	2.79%	32%	36%
1995	39.58%	3.03%	33%	38%
1996	44.26%	3.64%	37%	42%
1997	39.99%	3.18%	34%	38%
Average	**49.70%**	**3.76%**	**41.20%**	**46.87%**

Figure 5: Conventional and modified income of oil sector as % of GDP, 1970-1997 (KD 1995).



At the same time, the adjustments indicate that the rate of Kuwait's GDP growth is actually understated. Standard GDP calculations found 1.6 percent real average annual growth between 1970 and 1997. Over the same period the user cost adjusted income grew at a rate of 2.2 percent, while depreciation adjustment resulted in a real growth rate of 2.4 percent. The upward adjustments in income growth is the result of increasing oil prices and the rate of extraction, and hence the increasing of the magnitude of resource depletion adjustments since 1970s

In Kuwait, the immediate losses associated with resource exploitation appear to have been a non-rational component of the country's development strategy. Case studies of Costa Rica and Indonesia, which have calculated the depreciation costs for three sectors called for downward adjustments in both overall and

growth rates of GDP[9]. Though the time periods and the scope of these studies do differ, however, the results are similar. These results suggest that Kuwait has not made a successful transition from natural resource exploitation activities toward reproducible capital-related production.

Figure 6: Environmentally-adjusted measures of Kuwait's domestic capital formation 1970-1997

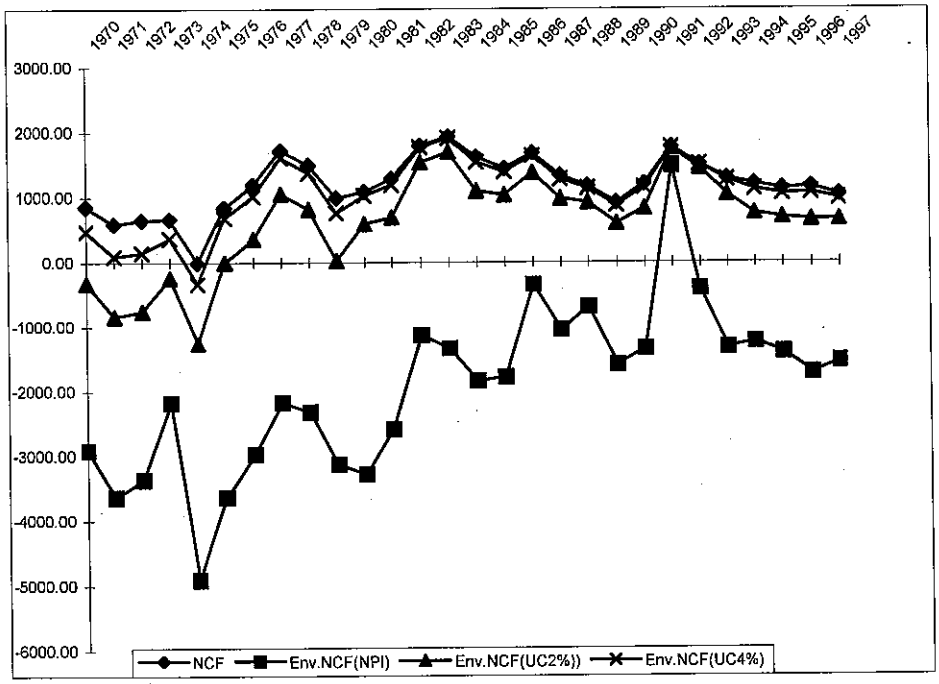


Table 5: Environmentally-adjusted measures of Kuwait's domestic capital formation 1970-1997

Year	NCF	Env.NCF(NPI)	Env.NCF(UC2%)	Env.NCF(UC4%)
1970	857.80	-2911.6	-325.49	477.893
1971	589.42	-3637.8	-843.21	93.5855
1972	650.06	-3371.3	-757.51	147.238
1973	666.66	-2175.3	-236.92	372.912
1974	-1.25	-4906.5	-1256.3	-330.96
1975	844.98	-3634.8	1.40536	680.89
1976	1190.37	-2966.7	365.197	1021.35
1977	1720.20	-2171.2	1057.3	1603.33
1978	1497.02	-2318.4	818.253	1372.15
1979	992.15	-3130.5	31.3473	761.805
1980	1084.70	-3283.8	595.342	1027.5
1981	1282.06	-2590.4	691.895	1188.78
1982	1788.76	-1128.8	1528.27	1764.39
1983	1926.16	-1336.3	1691.89	1908.45
1984	1619.82	-1841.4	1092.34	1536.44
1985	1438.11	-1776.2	1036.26	1385.8
1986	1678.35	-347.9	1375.61	1631.42
1987	1327.05	-1045.4	979.533	1274.21
1988	1174.12	-686.96	922.268	1138.69
1989	919.94	-1587.7	600.161	877.501
1990	1202.47	-1337.2	830.451	1145.91
1991	1768.23	1483.2	1744.25	1766.11
1992	1502.68	-410.32	1448.52	1501.04
1993	1287.44	-1315	1045.69	1263.92
1994	1200.59	-1227	758.446	1117.35
1995	1126.21	-1392.8	693.885	1049.43
1996	1153.94	-1712	652.227	1063.09
1997	1036.27	-1534.4	659.719	979.019

The revenues generated from natural resources have been directed mainly to consumption, instead of investment, in such a way that this shift has given rise to non-sustainable rates of economic growth. As a result, the depletion of natural resources has had a significant effect on the country's productive capital stock. For example, from 1970 to 1974 the depletion allowance almost doubled the depreciation of produced capital. Clearly, this conveys a different picture of overall capital or investment efficiencies in the oil and gas sector in comparison with one conveyed by conventional capital-output ratios. On the other hand, if the decline in oil and gas assets is charged against fixed capital formation for the 1970-1997 period, the user cost and depreciation costs would require annual downward adjustments, (see Figure 5). Natural resource assets depletion, calculated here for oil alone, appears a substantial cost of Kuwait's economic development, a cost of which policy makers should be made aware (see Figure 6). Oil depletion appears to reflect significant erosion of the total capital stock.

6- Conclusion

The two accounting approaches applied in this study differed in their implicit evaluations of oil and gas depletion. However, the two valuation methodologies produced oil and gas depletion adjustments of the same order of magnitude, following the same trends. Divergences occurred, however, in the size of cost of the adjusted income series. The user cost and depreciation methodologies suggested the same policy implication, apart from the size of the depletion allowance cost, with respect to Kuwait's oil exploitation. For an evidence, both depreciation and user cost approaches show that the average GDP was 40.4% lower using NPI and 13.82% and 8.06% lower using the user cost approaches with 2% and 4% discount rate, for the 1970-1997 period, respectively. However, regardless the

applied method used the adjusted net domestic product measures, as shown in Table 4, indicates that a significant percentage of Kuwait's income over 1970-1997 periods was actually consumption of natural resources.

The annual percentage change between depletion measures shows that, NPII showed the highest growth because of large increase in discoveries in 1970s and 1980s, which result mainly from discoveries. This measure showed the most volatility, too, because it is directly tied to change in reserves. In contrast, the user cost and NPI adjusted measures showed, smooth results with GDP, that appears in lower variance and coefficient variation too. This is one of their favours, because an important concern about including natural resource depletion in national income accounts is the volatility they may bring to income estimates. UN 93 and SEEA have proposed these two methods in estimating natural resource depletion. They have reported results based on this, but they have recommended NPI first and user cost as an alternative. Therefore, both methods will be used when estimating Kuwait's sustainable income. However, the user cost approach, in the case of Kuwait, offers much more appropriate results than depreciation approach (NPII and NPI), which goes in line with El Serafy proposition for United Nation to adopt user cost approach first and NPI as an alternative and not vis-à-vis.

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Footnotes:

1- It has to be mentioned that although this study applies the same models and techniques that have been applied in case of Egypt (see Attia, 2001), however, the results, analysis, and recommended models in case of Kuwait are quite different from those in case of Egypt. This divergence resulted mainly from the

huge variation in natural resource (oil) life span in both countries, e.g., the life span of oil reserves in Kuwait is about 95 years on average (see appendix) compared to 16 years on average in Egypt.

2- In the capital theoretic literature, it has been shown that the proper measure of the depreciation of a closed economy's stock of non-renewable resources is the total competitive rent, or total Hotelling rent, THR: see, for example, Hartwick (1990). With P for the price of the extracted resource, c for the marginal cost of extraction, R for the amount extracted, and N for new discoveries: δ_N = THR $= (P - c)^* (R - N)$.

3- Hartwick (1993) includes a generalisation of the model in Hartwick (1990) such that discovery costs increase with cumulative extraction, in which case measuring depreciation also requires data on marginal discovery costs, which is very rarely available.

4- It has to be noted that in the next sections, both Depreciation and User cost Models will be abbreviated as: NPII for Net Price II; NPI for Net Price I; and UC for User Cost.

5- see, e.g. contributions in Lutz (1993).

6- For discussion of the effects of oil upon development, i. e., the various symptoms of the "Dutch Disease" (See Levy, 1976).

7- From Figure 1, one could notice that there is a dramatic decrease in oil and gas production in 1991, this because 1991 was the year of Iraq invasion to Kuwait .

8- The results of 3% are more acceptable for the Kuwait's economy , as an average for 2 and 4%. and double the inflation rate reported in 1990s, therefore, 3 percent discount rate has been adopted as social discount rate for Kuwait's economy in all analysis (MOP. 1999).

9- The Costa Rica study (1991) incorporated depreciation for forest, soil and fisheries from 1970-1988, and called for a downward adjustment in average annual GDP growth over the period from 4.9 to 4.7 percent. In Indonesia (1989) forestry, soil and petroleum depreciation adjustments lower the 1970 to 1984 average annual growth rate from 7.1 to 4.0 percent.

Appendix

Table 6: Production of Crude Oil and Natural Gas

Year	Natural Gas (million cubic feet)	Crude Oil (thousand barrels)
1990	166.632	318.000
1991	34.481	65.803
1992	203.032	387.466
1993	359.724	686.497
1994	383.783	732.411
1995	383.789	732.422
1996	384.641	734.047
1997	383.869	732.574
Average	287.4939	548.6525

Source: Annual Statistics Abstract, Ministry of Planning, 1998 and 1999

Table 7: Balance Sheet of oil, 1970-1997 (billions of barrels)

Year	Opening Balance	New Discoveries	Net Change	Closing Balance	Life Span	Net Change
1970	64.900	1.0906	0.000	63.809	59	0.00
1971	64.900	1.1664	0.000	63.734	55	0.00
1972	64.900	1.2016	0.000	63.698	53	0.00
1973	64.900	1.1025	0.000	63.798	58	0.00
1974	64.900	0.9293	0.000	63.971	69	0.00
1975	64.900	0.7607	0.000	64.139	84	0.00
1976	64.900	0.7852	0.000	64.115	82	0.00
1977	64.900	0.7181	0.000	64.182	89	0.00
1978	64.900	2.8529	3.630	67.753	87	3.63
1979	68.530	1.5112	-0.600	67.019	74	-0.60
1980	67.930	0.8072	-0.200	67.123	111	-0.20
1981	67.730	0.9912	-0.580	66.739	162	-0.58
1982	67.150	0.45	-0.150	66.700	222	-0.15
1983	67.000	25.3259	25.710	92.326	240	25.71
1984	92.710	0.6706	-0.246	92.039	217	-0.25
1985	92.464	-1.6707	2.058	94.135	243	2.06
1986	94.522	0.5138	0.003	94.008	182	0.00

1987	94.525	0.5347	0.000	93.990	176	0.00
1988	94.525	3.934	3.600	78.591	183	-15.40
1989	97.125	-1.2645	-0.100	96.390	152	-0.10
1990	97.025	0.9601	-0.525	96.065	221	-0.53
1991	96.500	0.0719	0.000	96.428	1341	0.00
1992	96.500	0.3964	0.000	96.104	242	0.00
1993	96.500	0.6866	0.000	95.813	140	0.00
1994	96.500	0.7322	0.000	95.768	131	0.00
1995	96.500	0.7307	0.000	95.769	131	0.00
1996	96.500	0.7486	0.000	95.751	128	0.00
1997	96.500	0.7326	0.000	95.767	131	0.00