Valuation of Oil and Gas Reserves in the Netherlands

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Government appropriation of net resource rent for subsoil assets - An analysis for the Netherlands

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Preface

Eurostat is working on **the valuation of sub-soil assets** as part of work to develop environmental accounts linked to national accounts. In October 2000, Eurostat published *'Accounts for subsoil assets - Results of pilot studies in European countries'* (Office for Official Publication of the European Communities, Luxembourg). This publication includes an estimate of the value of oil and gas reserves in the EU and the EEA based on the results of pilot studies in Denmark, France, Netherlands, Norway, Austria and the United Kingdom. The publication also describes the methods for compiling monetary and physical subsoil asset accounts.

For this publication, Statistics Netherlands provided both methodological and data input. One key methodological input was a paper entitled 'Government appropriation of net resource rent for subsoil assets; An analysis for the Netherlands' (André van den Berg and Peter van de Ven, June 2000).

This Working Paper is an expanded version of the June 2000 paper by André van den Berg and Peter van de Ven. The Working paper documents the methods and data sources used as well as the results for both the total value of Dutch oil and gas reserves and the government appropriation of the resource rent from extraction.

Eurostat distributes this Working Paper hoping that compilers of accounts for subsoil assets and researchers can benefit from the methods and data presented.

The work on subsoil asset accounts is continuing at Eurostat. The focus is on collecting and regularly producing monetary and physical accounts for subsoil assets in the EU and the EEA.

Brian Newson
Head of Unit B1
National accounts methodology,
statistics of own resources

Eurostat Environmental Accounting publications

Official publications

- NAMEAs for air emissions – Results of Pilot Studies (2001)
- Environmental Taxes – A Statistical Guide (2001)
- Economy-wide Material Flow Accounts and derived Indicators – A Methodological Guide (2001)
- Accounts for Subsoil Assets – Results of Pilot Studies in European Countries (2000)
- Valuation of European Forests - Results of IEEAF Test Applications (2000)
- Environmental Taxes in the EU – Statistics in Focus Theme 2 – 20/2000
- European Handbook for Integrated Environmental and Economic Accounting for Forests – IEEAF (2000)
- Pilot Studies on NAMEAs for air emissions with a comparison at European level (1999)
- The Environmental Goods & Services Industry – Manual for data collection and analysis (OECD/Eurostat, Paris 1999)
- The European Framework for Integrated Environmental and Economic Accounting for Forests: Results of pilot applications (1999)
- From research to implementation: policy–driven methods for evaluating macro-economic environmental performance – proceedings from a workshop, Luxembourg 28-29 September 1998 (DG Research Report Series 1999/1)
- The European System for the Collection of Economic Information on the Environment – SERIEE 1994 Version (1994). Also available in DE, FR and ES.

Eurostat Working Papers

- Material use indicators for the European Union, 1980-1997 (2/2001/B/2)
- Uses of Environmental Accounts in Sweden (2/2001/B/1)
- Environment taxes and subsidies in Danish NAMEA (2/2000/B/12)
- Environment taxes and environmentally harmful subsidies in Sweden (2/2000/B/11)
- The environment industry in Sweden, 2000 (2/2000/B/10)
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- Material flow accounts - material balance and indicators, Austria 1960-1997 (2/2000/B/6)
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- Environment-related employment in Netherlands, 1997 (2/2000/B/3)
- Material flows accounts – DMI and DMC for Sweden, 1987-1997 (2/2000/B/2)
- Material flows accounts - TMR, DMI and material balances, Finland 1980-1997 (2/2000/B/1)
- A material flow account for sand and gravel in Sweden (2/1999/B/4)
- The Environment Industry in Sweden (Nr. 2/1999/B/3)
- Industrial Metabolism (Nr. 2/1999/B/2)
- The Policy Relevance of Material Flow Accounts (Nr. 2/1999/B/1)
- The Economy, Energy and Air Emissions (Nr. 2/1998/B/2)
- Physical Input-Output Tables for Germany, 1990 (Nr. 2/1998/B/1)
- An Estimate of Eco-Industries in the European Union 1994 (Nr. 2/1997/B/1)

Eurostat internal publications

- Natural resource accounts and environmental Input-Output tables for Greece 1988-1998 (9/2000)
- Statistics on Environmental taxes and other economic instruments for environmental protection in EU Member States (11/1999)
- Material Flow Accounting – Experience of Statistical Institutes in Europe (12/1997)

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Contents

1 Introduction

According to the 1995 ESA, subsoil assets (AN.212) are defined as proven reserves of mineral deposits located on or below the earth's surface that are economically exploitable given current technology and relative prices. In the absence of market prices, the value of the reserves usually has to be determined by the present value of expected future net returns resulting from the commercial exploitation of those assets.

To estimate expected net returns in relation to subsoil assets, in practice, two alternative methods can be applied: the 'Net Resource Rent Method' and the 'Government Appropriation Method'. In this context, 'net resource rent' stands for net operating surplus plus specific taxes less the return to fixed capital (for detail see Eurostat 2000). The latter item is to be calculated as the normal rate of return to fixed capital times total net stock of fixed capital.

In many countries, general government is the primary owner of the subsoil assets and/or the rights to exploit these reserves. By rewarding the exploitation rights to a company, government may appropriate a significant part of the 'net resource rent' from exploitation. Under the assumption, that the price of the rights are negotiated or auctioned under competitive circumstances, extracting companies should only be able to receive a 'normal' rate of return to capital, and government should appropriate (nearly) the whole resource rent. On the basis of these assumptions, the 'Government Appropriation Method' is an alternative to the 'Net Resource Rent Method', with government receipts related to the exploitation of subsoil assets representing the 'net resource rent'.

In this paper, both methods for the estimation of expected net returns are compared with each other for the Netherlands. First, in section 2, the calculation of 'net resource rent' is discussed. Subsequently, section 3 dwells upon Dutch regulations in relation to the exploitation of natural reserves. Here, special attention is paid to the ways in which Dutch government appropriates income from the extracting companies. The calculation of the government appropriation of the resource rent is discussed in section 4. In section 5, the results for the two alternative methods are compared with each other. In section 6, the estimates of government appropriation are used to calculate the value of oil and gas reserves in the Netherlands. The paper is finalised with some (provisional) conclusions in section 7.

2 The calculation of the net resource rent

The results for the calculation of the 'net resource rent' are presented in table 1. Data on operating surplus, consumption of fixed capital and capital stock for the industry 'extraction of crude petroleum and natural gas' could be derived from the Dutch system of national accounts. The data, however, had to be adjusted for the Dutch company 'Gasunie'. This company is primarily involved in distribution of gas, but is included in the extracting industry for reasons of confidentiality. Data from the annual reports of the 'Gasunie' have been used for the adjustment; the possible mistake is considered to be rather small. Furthermore, it was not possible to make a distinction between oil and gas.

To arrive at the rent that can be attributed to the natural resources, net operating surplus has to be adjusted for a 'normal' return on investment other than the relevant natural resources. In the Summary of Conclusions and Results of the Eurostat Task Force on Subsoil Assets (Luxembourg, September 1999, ACCT-ENV/99/7.3.2 – Revised), 'investment' is represented by the net stock of fixed capital. For the 'normal rate of return to fixed capital', a real rate of 8 to 10% has been agreed upon. This rate is considered to be a proper indication of the opportunity costs of capital, by reference to the average real rate of return to capital elsewhere in the economy.

In defining and calculating a 'normal' return to investments, two issues need further discussion: (i) the coverage of investments, and (ii) the appropriate rate of return when comparing the 'net resource rent method' and the 'government appropriation method'.

In relation to the coverage of investments, there are good reasons to consider net stock of fixed capital as too limited. In addition to fixed assets, investments in other assets are also needed for running an enterprise. Here, one can, for example, think of (structural) levels of inventories, cash and deposits, accounts receivable, etc. However, as the relevant data are not available, the net stock of

fixed assets has been applied in the calculation of the 'net resource rent'. Whether or not the inclusion of other assets significantly affects the Dutch results, is a possible topic for further research.

The other point of discussion, the appropriate rate of return, concerns the choice between the application of the default rate of 8% (as proposed by the Eurostat Task Force on Subsoil Assets), or the application of a rate of 8% *plus* a general indicator for the change in prices.

When money is invested in a certain activity, the investor wants to have a compensation for making his money available to another unit by giving up possibilities of direct spending. If the investment also contains an element of risk, a risk premium will be added. Apart from this, the investor also wants to be compensated for a possible devaluation of his investment as a consequence of inflation. Therefore, it could be argued that it is more appropriate to use a rate of 8% *plus* a general indicator for price inflation. This would be in line with the recommendation of the Task Force to apply a <u>real</u> rate of return of 8 to 10%. On the other hand, in this paper the national accounts data for net capital stock at replacement costs are used for calculating the return to fixed capital. In this case the holding gain on the <u>fixed</u> capital stock should 'take care' of inflation adjustment.

The results presented in table 1 include also an 'inflation-adjusted' variant for illustrative purposes. Note that the value of Dutch subsoil assets presented in section 6 is based on the 'non-inflation-adjusted' results.

Table 1. Net resource rent, 1975-1998, million HFL, in current prices

Year	Operating surplus (gross)	Consumption of fixed capital	Operating surplus (net)	Capital stock (gross)	Capital stock (net)	Return to fixed capital (r=8)	Return to fixed capital (r=8+inflation)	Resource rent (r=8)	GDP-deflator, changes in %	Resource rent (r=8+inflation)	Effect of inflation adjustment on the rent, in %
1975	8 246	398	7 848	11 092	9 388	751	1 709	7 097	10,2	6 139	-13,5
1976	10 866	475	10 391	12 849	10 844	867	1 822	9 523	8,8	8 569	-10,0
1977	12 156	529	11 627	14 171	11 891	951	1 736	10 676	6,6	9 891	-7,4
1978	11 515	595	10 920	15 838	13 214	1 057	1 757	9 863	5,3	9 162	-7,1
1979	13 543	667	12 876	17 615	14 572	1 166	1 763	11 710	4,1	11 113	-5,1
1980	18 272	751	17 521	19 605	16 023	1 282	2 163	16 239	5,5	15 358	-5,4
1981	23 699	858	22 841	22 154	17 895	1 432	2 398	21 409	5,4	20 443	-4,5
1982	24 145	960	23 184	24 575	19 665	1 573	2 635	21 611	5,4	20 549	-4,9
1983	25 603	1 036	24 567	26 233	20 777	1 662	2 099	22 905	2,1	22 469	-1,9
1984	29 022	1 120	27 903	28 115	22 068	1 765	2 074	26 137	1,4	25 828	-1,2
1985	33 228	1 220	32 009	30 631	23 968	1 917	2 349	30 091	1,8	29 660	-1,4
1986	20 935	1 242	19 693	29 442	23 427	1 874	1 898	17 819	0,1	17 795	-0,1
1987	13 235	1 265	11969	29 139	22 758	1 821	1 661	10 149	- 0,7	10 308	1,6
1988	10 209	1 317	8 891	29 930	22 616	1 809	2 081	7 082	1,2	6 811	-3,8
1989	10 900	1 427	9 473	32 199	23 423	1 874	2 155	7 599	1,2	7 318	-3,7
1990	12 814	1 511	11 303	33 876	23 825	1 906	2 454	9 397	2,3	8 849	-5,8
1991	15 668	1 599	14 069	35 930	24 798	1 984	2 653	12 085	2,7	11 416	-5,5
1992	13 446	1 714	11 732	38 636	26 271	2 102	2 706	9 630	2,3	9 026	-6,3
1993	12 498	1 847	10 652	42 242	28 648	2 292	2 836	8 360	1,9	7 815	-6,5
1994	12 183	1 937	10 246	43 968	29 536	2 363	3 042	7 883	2,3	7 204	-8,6
1995	12 997	2 001	10 996	44 514	29 603	2 368	2 901	8 628	1,8	8 095	-6,2
1996	15 565	2 075	13 489	46 320	30 142	2 411	2 773	11 078	1,2	10 716	-3,3
1997	15 744	2 173	13 571	47 896	30 620	2 450	3 062	11 122	2,0	10 509	-5,5
1998	13 795	2 303	11 492	49 643	31 118	2 489	3 081	9 002	1,9	8 411	-6,6

For the general indicator of price inflation, the deflator of Gross Domestic Product (GDP) at market prices has been used. From table 1, it can be concluded that using an inflation-adjusted rate of return to capital can significantly affect the results for the 'net resource rent'. This can be explained by the combination of the level of inflation itself and the capital stock/operating surplus ratio. The larger the capital stock relative to operating surplus and the larger the GDP-deflator, the larger the effect of accounting for inflation on the rent.

3 Dutch regulations on exploitation of oil and natural gas

Dutch natural resources mainly consist of natural gas, among which the large reserves in the North of the Netherlands (Slochteren, province of Groningen). In addition, there are some reserves of oil, salt, gravel and coal, of which the latter are not economically exploitable given current technology and relative prices; the last coal mines were closed down in the Seventies.

In principle, general government is the legal owner of all subsoil assets that are present on Dutch territory. A company that wants to bore for natural reserves, needs 'prospecting rights' to be rewarded by government. They give the right to explore for natural gas (or oil) in a certain part of the Dutch territory (including the continental shelf). For the rights, a certain amount (dependent on the surface) has to be paid to the Dutch government.

After a discovery of reserves, 'exploitation rights' are rewarded to an extracting company. At the same time, also the legal ownership of the reserves is transferred to the extracting company, until the reserves have been depleted. To obtain exploitation rights, certain conditions have to be met. One of the conditions is the right of Dutch government to participate in the exploitation of the reserves. This is done by a company named Energie Beheer Nederland (EBN, Energy Management Netherlands). Until 1976, the participation was 40% maximum, after that year 50% maximum. The largest extracting company in the Netherlands is the Nederlandse Aardolie Maatschappij (NAM, Dutch Oil Company), owned by Shell and Esso. Together with EBN, this company exploits the major part of natural gas reserves on the mainland, among which the one in Groningen. On the continental shelf, more than half of the exploitation rights is owned by other companies.

Apart from corporate taxes, general government appropriates a significant share of the income from subsoil assets. The following sources of income can be distinguished:
- Receipts from the Law on Mining Activities (Opbrengsten Mijnwetgeving).
  Income from prospecting and exploitation rights. Apart from receipts depending on the surface and the volume extracted, government receives a fixed part of net income (after corporate taxes). For rights issued before 1967, this part was 10%. After 1967, the share has been increased to 50%, and, after 1976, to 70% of net income (after corporate taxes).
- Extra earnings from Groningen (Meeropbrengsten Groningen).
  In 1975, new arrangements have been negotiated between government and the extracting company with regard to the Groningen reserves. From that year onwards, the share of net income appropriated by government is depending on the market price of natural gas. Government receipts range from 70% of net income (market price is within the first indexed 'slice'), up to 85% (second 'slice') and 95% (third 'slice').
- Income from the EBN-participation (Aardgasbaten via EBN).
  Extraordinary dividend receipts from the participation of EBN in the exploitation of oil and gas.

4 Calculating government appropriation of resource rent

Data on the income appropriated by government have been derived from the State Budget. Doing so, realised revenues have been used. As in the case of the 'net resource rent', it was not possible to make a distinction between oil and gas. The largest source of income is the item 'extra earnings from Groningen', especially in years with high oil and gas prices. The maximum amount was more than 14 billion guilders in 1985. The 'income from the EBN-participation' is usually within ranges of 1 to 3 billion guilders, whereas the 'receipts from the Law on Mining Activities' ranges from 0.5 to 1.5 billion guilders.

From the above, it can be derived that nearly all income appropriated by government is defined as a share of the extracting company's income after corporate taxes. Only a minor part of 'receipts from the Law on Mining Activities' is depending on the surface and the volume extracted, with most of the receipts coming from the 'fixed part of net income after corporate taxes'. As a consequence, government is actually collecting corporate taxes from nearly all the resource rent before it is appropriated. If one only considers the specific income items, listed above, as income appropriated by government, all corporate taxes would be included in the resource rent appropriated by the extracting company. This would include the corporate tax paid on the government revenues. It is thus more logical to allocate corporate taxes partly to income appropriated by government, and partly to income appropriated by the extracting companies.

Two possible adjustments can be made for corporate taxes. First, one can distribute corporate taxes proportionally to the above-mentioned income items appropriated by government (excluding receipts depending on surface and volume extracted) and to the net income of the extracting companies resulting after corporate taxes and specific payments to government. Doing so, corporate taxes are still charged against all income (i.e. normal return to fixed capital as well as resource rent) appropriated by the extracting companies. The other alternative is to allocate only that part of corporate taxes to the extracting companies that corresponds with an average rate of corporate taxes on the normal return to fixed capital. In that case, the resource rent appropriated by extracting companies is defined after taxation. In the following, the second alternative has been applied.

The data on corporate taxes as well as on 'prospecting rights' received by government from the extracting companies have been derived from the State Budget. According to the ESA '…royalties that accrue to owners of deposits of minerals or fossil fuels (coal, oil or natural gas) who grant leases to other institutional units permitting them to explore or to extract such deposits …' are part of the rent on sub-soil assets and thus included in operating surplus (ESA 1995, § 4.74). No corporate taxes are attributed to these 'prospecting rights'. For splitting total corporate income tax revenue between 'rent' and 'return to capital', an 'adjusted operating surplus' is first calculated by subtracting the 'prospecting rights' from net operating surplus. Then, the corporate taxes are expressed as a percentage of this adjusted operating surplus. The resulting percentage is used to calculate 'corporate taxes on return to fixed capital'. Subtracting 'corporate taxes on return to fixed capital' from total corporate taxes gives 'corporate taxes on rent'. Adding government appropriation (other than the corporate taxes on rent) results in 'government appropriation including corporate taxes on rent'. The calculations are shown in table 2.

Table 2: Government appropriation including corporate taxes on rent, 1975-1998, million HFL

Year	Operating surplus (net)	Prospecting rights	Operating surplus (adjusted)	Corporate taxes (mln gld)	Corporate taxes (%)	Return to fixed capital (r=8)	Return to fixed capital (r=8+inflation)	Corporate taxes on return to fixed capital (r=8)	Corporate taxes on return to fixed capital (r=8+inflation)	Corporate taxes on rent (r = 8)	Corporate taxes on rent (r=8+inflation)	Government appropriation (excl. corp. taxes)	Government appropriation (incl. corp. taxes on rent, r=8)	Government appropriation (incl. corp. taxes on rent, r=8+inflation)
1975	7 848	3	7 844	2 390	30	751	1 709	229	521	2 161	1 869	2 979	5 140	4 848
1976	10 391	5	10 386	2 620	25	867	1 822	219	460	2 401	2 160	4 833	7 234	6 993
1977	11 627	9	11 618	2 740	24	951	1 736	224	409	2 516	2 331	5 725	8 241	8 056
1978	10 920	21	10 899	2 800	26	1 057	1 757	272	451	2 528	2 349	5 632	8 160	7 981
1979	12 876	69	12 807	3 020	24	1 166	1 763	275	416	2 745	2 604	6 809	9 554	9 413
1980	17 521	81	17 440	4 190	24	1 282	2 163	308	520	3 882	3 670	9 434	13 316	13 104
1981	22 841	101	22 739	5 400	24	1 432	2 398	340	569	5 060	4 831	13 516	18 576	18 347
1982	23 184	137	23 047	5 400	23	1 573	2 635	369	617	5 031	4 783	13 980	19 011	18 763
1983	24 567	139	24 428	5 400	22	1 662	2 099	367	464	5 033	4 936	13 740	18 773	18 676
1984	27 903	194	27 708	5 700	21	1 765	2 074	363	427	5 337	5 273	15 953	21 290	21 226
1985	32 009	261	31 747	5 600	18	1 917	2 349	338	414	5 262	5 186	19 019	24 281	24 205
1986	19 693	196	19 497	4 100	21	1 874	1 898	394	399	3 706	3 701	11 786	15 492	15 487
1987	11 969	177	11 792	2 700	23	1 821	1 661	417	380	2 283	2 320	6 510	8 793	8 830
1988	8 891	129	8 762	2 100	24	1 809	2 081	434	499	1 666	1 601	4 560	6 226	6 161
1989	9 473	104	9 369	1 900	20	1 874	2 155	380	437	1 520	1 463	4 792	6 312	6 255
1990	11 303	228	11 075	2 384	22	1 906	2 454	410	528	1 974	1 856	5 760	7 734	7 616
1991	14 069	221	13 848	2 976	21	1 984	2653	426	570	2 550	2 406	8 185	10 735	10 591
1992	11 732	229	11 503	2 458	21	2 102	2 706	449	578	2 009	1 880	6 756	8 765	8 636
1993	10 652	195	10 457	2 243	21	2 292	2 836	492	608	1 752	1 635	6 250	8 002	7 885
1994	10 246	145	10 101	2 000	20	2 363	3 042	468	602	1 532	1 398	5 178	6 710	6 576
1995	10 996	148	10 848	2 100	19	2 368	2 901	458	562	1 642	1 538	6 456	8 098	7 995
1996	13 489	172	13 318	2 600	20	2 411	2 773	471	541	2 129	2 059	8 596	10 725	10 655
1997	13 571	205	13 367	2 300	17	2 450	3 062	421	527	1 879	1 773	8 064	9 942	9 837
1998	11 492	248	11 243	2 700	24	2 489	3 081	598	740	2 102	1 960	5 662	7 764	7 622

5   Results and comparison with total resource rent

In table 3, the 'Net Resource Rent Method' and the 'Government Appropriation Method' are compared with each other. Three alternatives are presented. First, in column 6 of table 3, only specific receipts have been taken into account as resource rent appropriated by government; no corporate taxes have been included. This income is presented as a percentage of total resource rent assuming a normal rate of return of 8%. In the following column, column 7, part of corporate taxes has also been allocated to income appropriated by government, in line with the second alternative discussed in the above section. Finally, in column 8, total resource rent has been calculated assuming a normal rate of return of 8% plus a compensation for inflation. This also affects the allocation of corporate taxes to income appropriated by government; see column 5.

Furthermore, in graph 1 (see the graphs in Annex), the results for 'government appropriation' (excluding and including corporate taxes) are shown next to 'net resource rent' using 8% as the 'normal' rate of return. Data adjusted for inflation are depicted in graph 2. Finally, in graph 3, 'government appropriation' is shown as a percentage of 'net resource rent', for each of the alternatives distinguished.

Using the second alternative (column 7) as the starting point, government has appropriated on average 85% of the resource rent in the period from 1975 to 1998. The application of 8% plus inflation, instead of 8%, as the normal rate of return (column 8) results in an increase to 88% on average. The results, however, are far more affected by not allocating part of corporate taxes to the resource rent appropriated by government. In that case, only an average of 63% results.

Furthermore, it shows that the percentage appropriated by government is increasing, from an average of 78% (using the second alternative presented in column 7) in the second half of the Seventies to 84% in the Eighties, and 90% in the Nineties. Starting from the third alternative (column 8), the relevant shares are 83%, 86%, and 94%, respectively. Two reasons may account for this increase: improved contracts for exploitation rights rewarded after 1967 and 1976, and a higher percentage of the income from the Groningen reserves due to increases in oil and gas prices (see section 3). Unfortunately, data can not be distinguished by the year in which the exploitation rights are rewarded. In that case, a comparison between 'net resource rent' and 'government appropriation' would be possible for 'old' contracts versus 'new' contracts.

Finally, it shows that only in 1993 (and only for the third alternative) government revenues exceed 'net resource rent'; the difference, however, is very small. As both net resource rent as well as most government revenues from subsoil-assets are defined as a fraction of net income, this result is hardly surprising. For it is to be expected that entrepreneurs, while negotiating with government will see to it that total government revenues will not exceed the fraction of net income destined for net resource rent.

Table 3: Government appropriation, 1975-1998, million HFL and as a percentage of the resource rent, in current prices

Year	(1) Resource rent (r=8)	(2) Resource rent (r=8+inflation)	(3) Government appropriation (excl. corp. taxes)	(4) Government appropriation (incl. corp. taxes on rent, r=8)	(5) Government appropriation (incl. corp. taxes on rent, r=8+inflation)	(6) = (3) / (1) x 100	(7) = (4) / (1) x 100	(8) = (5) / (2) x 100
1975	7 097	6 139	2 979	5 140	4 848	42	72	79
1976	9 523	8 569	4 833	7 234	6 993	51	76	82
1977	10 676	9 891	5 725	8 241	8 056	54	77	81
1978	9 863	9 162	5 632	8 160	7 981	57	83	87
1979	11 710	11 113	6 809	9 554	9 413	58	82	85
1980	16 239	15 358	9 434	13 316	13 104	58	82	85
1981	21 409	20 443	13 516	18 576	18 347	63	87	90
1982	21 611	20 549	13 980	19 011	18 763	65	88	91
1983	22 905	22 469	13 740	18 773	18 676	60	82	83
1984	26 137	25 828	15 953	21 290	21 226	61	81	82
1985	30 091	29 660	19 019	24 281	24 205	63	81	82
1986	17 819	17 795	11 786	15 492	15 487	66	87	87
1987	10 149	10 308	6 510	8 793	8 830	64	87	86
1988	7 082	6 811	4 560	6 226	6 161	64	88	90
1989	7 599	7 318	4 792	6 312	6 255	63	83	85
1990	9 397	8 849	5 760	7 734	7 616	61	82	86
1991	12 085	11 416	8 185	10 735	10 591	68	89	93
1992	9 630	9 026	6 756	8 765	8 636	70	91	96
1993	8 360	7 815	6 250	8 002	7 885	75	96	101
1994	7 883	7 204	5 178	6 710	6 576	66	85	91
1995	8 628	8 095	6 456	8 098	7 995	75	94	99
1996	11 078	10 716	8 596	10 725	10 655	78	97	99
1997	11 122	10 509	8 064	9 942	9 837	73	89	94
1998	9 002	8 411	5 662	7 764	7 622	63	86	91

6 Valuation of gas and oil reserves in the Netherlands

The government appropriation of the net resource rent from oil and gas as calculated in this paper differs (significantly) from earlier estimates published in Statistics Netherlands' National Accounts Occasional Paper Nr. NA-088 'Measurement and Valuation of Gas and Oil Reserves in the Netherlands' (Pommée 1998), mainly because of different assumptions. Because of this, the value of oil and gas reserves in the Netherlands is recalculated for the 1990-1998 period, based on the new estimates of government appropriation of net resource rent.

Note: The figures in this section are preliminary estimates. Before these estimates can actually be implemented, Statistics Netherlands will consult its main users, among which the Netherlands' Ministry of Finance and the Ministry of Economic Affairs.

6.1 Valuation Method and Results

Valuation of the reserves of natural gas and oil is pursued on the basis of the net present value of the specific revenues by the government from natural gas and oil, as an approximation of the expected net future returns. For the 1990-1998 period, the government appropriation (including corporate taxes on rent, r=8) has been seen as the specific revenues by the government from natural gas and oil (see section 4 on government appropriation). The rate of discount has been set equal to the moving 10-year average (nominal) rate of interest on long term government bonds (derived from the Statistical Yearbook). This means that for both government appropriation and the rate of discount, realised (ex post) figures have been used, when available.

Table 4: Government appropriation of net resource rent for subsoil assets, million HFL; rate of interest on long term government bonds (%)

Year	Government appropriation, Million HFL	Rate of interest on long term government bonds (%)	10-year average interest rate (%)
1981		11,53	
1982		9,91	
1983		8,24	
1984		8,11	
1985		7,32	
1986		6,36	
1987		6,36	
1988		6,11	
1989		7,21	
1990	7 734	8,99	8,01
1991	10 735	8,78	7,74
1992	8 765	8,15	7,56
1993	8 002	6,20	7,36
1994	6 710	6,67	7,22
1995	8 098	6,49	7,13
1996	10 725	5,63	7,06
1997	9 942	5,15	6,94
1998	7 764	4,40	6,77

Following the Plan of Gas Supply of Dutch Gas, a lifetime of 25 years is used for both oil and gas (based on the plan period of the Plan of Gas Supply). As total reserves of natural gas are assumed to be sufficient for 25 years, the revenues for 1998 have been applied to the remaining years in order to obtain estimates of total revenues. Moreover, as the revenues for years after 1998 are not affected by inflation, a real discount rate of 4 per cent has been applied (in accordance with the official recommendations of the Netherlands' Ministry of Finance: Governments' Standpoint; Reconsidering the Discount Rate). From this and the results from table 4 the value of gas and oil reserves in the Netherlands for the 1990-1998 period can easily be derived. The results are presented in table 5.

Table 5: Value of oil and gas subsoil assets

Present value at:	Million HFL
01-01-1990	103 424
01-01-1991	106 260
01-01-1992	106 113
01-01-1993	107 818
01-01-1994	110 274
01-01-1995	114 122
01-01-1996	116 843
01-01-1997	117 125
01-01-1998	118 146

6.2   Confrontation with earlier estimates

As stated earlier, the estimates in this exercise differ from earlier estimates published in Occasional Paper Nr. NA-088 'Measurement and Valuation of Gas and Oil Reserves in the Netherlands'. As the latter only contains estimates for 1990 and 1991, the results of both studies are compared for this period only.

Table 6: Valuation of subsoil assets, updated estimates vs. earlier estimates.

Present value at:	Earlier estimate			Updated estimate	Difference	
	Natural gas	Oil	Total	Total		
	Million HFL			*Million HFL*	*Million HFL*	*%*
01-01-90	59 317	13 877	73 194	103 424	30 230	41
01-01-91	58 171	15 232	73 403	106 260	32 857	45

From table 6 it follows that the estimates of the value of subsoil assets can differ significantly, depending on the assumptions made and the methods applied. The updated estimate of the present value of Dutch natural gas and oil reserves for 1990 and 1991 are about 41% and 45% higher as the earlier estimates.

7   Conclusions

From the data presented in table 3 it can be concluded that, from the Seventies onwards, government appropriates the greater part of 'net resource rent'. It can also be concluded that for recent years the 'Government Appropriation Method' is a good alternative for the 'Net Resource Rent Method'. In using the 'Government Appropriation Method', one should add to the specific income items of government the corporate taxes that fall on these specific income items.

In the case of 'old' contracts, the 'Government Appropriation Method' seems not applicable. Looking at the results for the earlier years under review, it can be assumed that extracting companies have retained a substantial part of the resource rent from the exploitation of natural resources rewarded under the arrangements of 'old' contracts. From contracts rewarded before 1967, government only appropriated 10% of net income (after corporate taxes). Apart from the Groningen reserves - for which special arrangements have been made -, this percentage has increased to 50% for contracts rewarded between 1967 and 1976, and to 70% for contracts rewarded after 1976.

A possible point for further research is the way in which the application of national accounts data may have affected the comparison. As a consequence of the use of these data, there may be three reasons for a mismatch in the comparison of 'net resource rent' and 'government appropriation'. First of all, profit and loss accounts according to business accounting practice may deviate from national accounting guidelines. Secondly, due to some deficiencies in the source data on extraction companies, national accounts data may contain a certain degree of error. Finally, the national accounts data may contain some companies which are irrelevant for the comparison of the two methods.

Another point for further research may be the inclusion of other assets (inventories, cash and deposits, other accounts receivable, etc.) when estimating a normal return to investments; see also section 2. Unfortunately, a comparison of the 'Net Resource Rent Method' and the 'Government Appropriation Method' for 'old' contracts versus 'new' contracts is not possible due to lack of data.

In the Netherlands, the legal ownership of natural resources is transferred from government to the extracting company, after the right to exploit the relevant resources has been rewarded. In the Dutch system of national accounts, this acquisition and disposal is valued at the net present value of expected net revenues appropriated by government. The resulting value is put on the balance sheets, as an asset of government and as a liability of the extracting industry, under the item '(present value of) revenues from oil and gas'. For the same amount, natural resources are registered as an asset of the extracting industry. However, due to the rather large difference between 'net resource rent' and 'government appropriation', the valuation of natural assets based on the government appropriation method may need further consideration for the earlier years under review in this paper.

More generally, the following conclusions can be offered:
- The 'Government Appropriation Method' is a valid alternative to the 'Net Resource Rent Method'.
- It may be particularly useful when the data for the 'Net Resource Rent Method' are not complete or cannot be used, e.g. due to confidentiality regimes.
- The 'Government Appropriation Method' requires a careful analysis of the tax regimes applied to the natural resources under review.
- Rent calculation with the 'Net Resource Rent Method' based on national accounts data requires testing the representativity of the national accounts data for the resource extraction activity in question. This relates first of all to the 'purity' of the industry – ideally data would relate to branches of production rather than industries. Evidently, the 'Net Resource Rent Method' is sensitive to the assumptions on return to capital.
- Calculating the share of the resource rent appropriated by government is useful in itself and also required for properly calculating the values of natural assets in sectoral balance sheets.
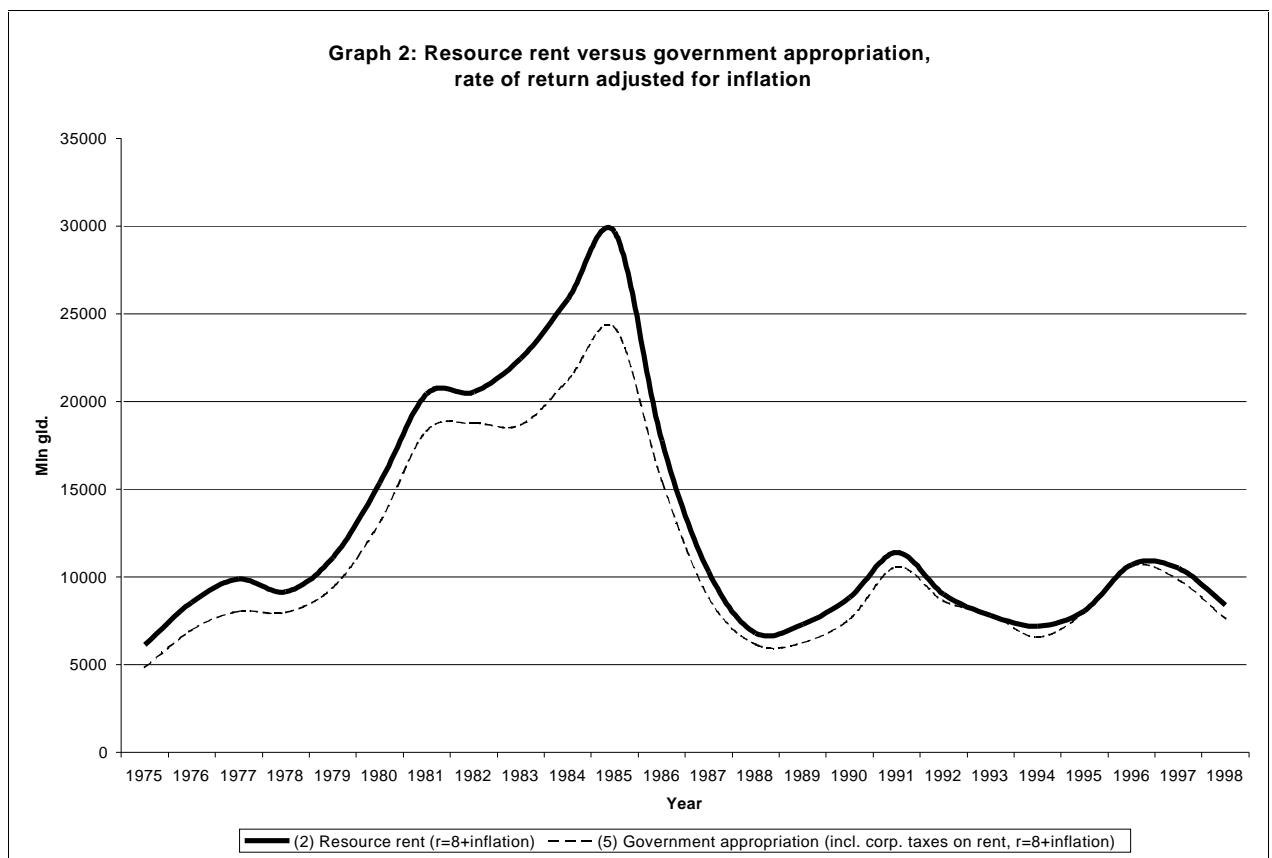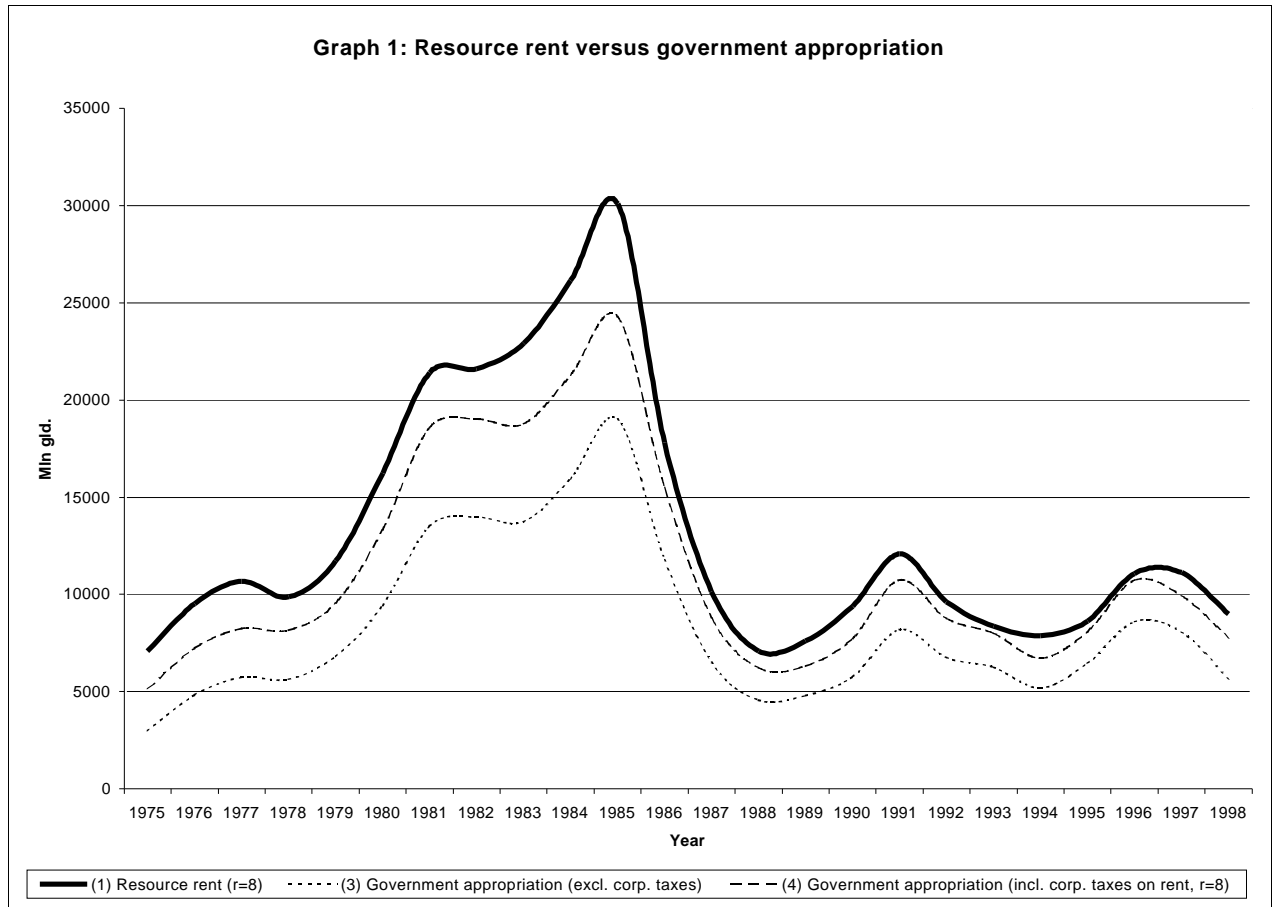

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Annex (graphs to Table 3)

Graph 1: Resource rent versus government appropriation

Legend: (1) Resource rent (r=8) ; (3) Government appropriation (excl. corp. taxes) ; (4) Government appropriation (incl. corp. taxes on rent, r=8)

Graph 2: Resource rent versus government appropriation, rate of return adjusted for inflation

Legend: (2) Resource rent (r=8+inflation) ; (5) Government appropriation (incl. corp. taxes on rent, r=8+inflation)

Graph 3: Government appropriation of resource rent, in %

Legend: ······· (6) = (3) / (1) x 100   – – – (7) = (4) / (1) x 100   ▬▬▬ (8) = (5) / (2) x 100