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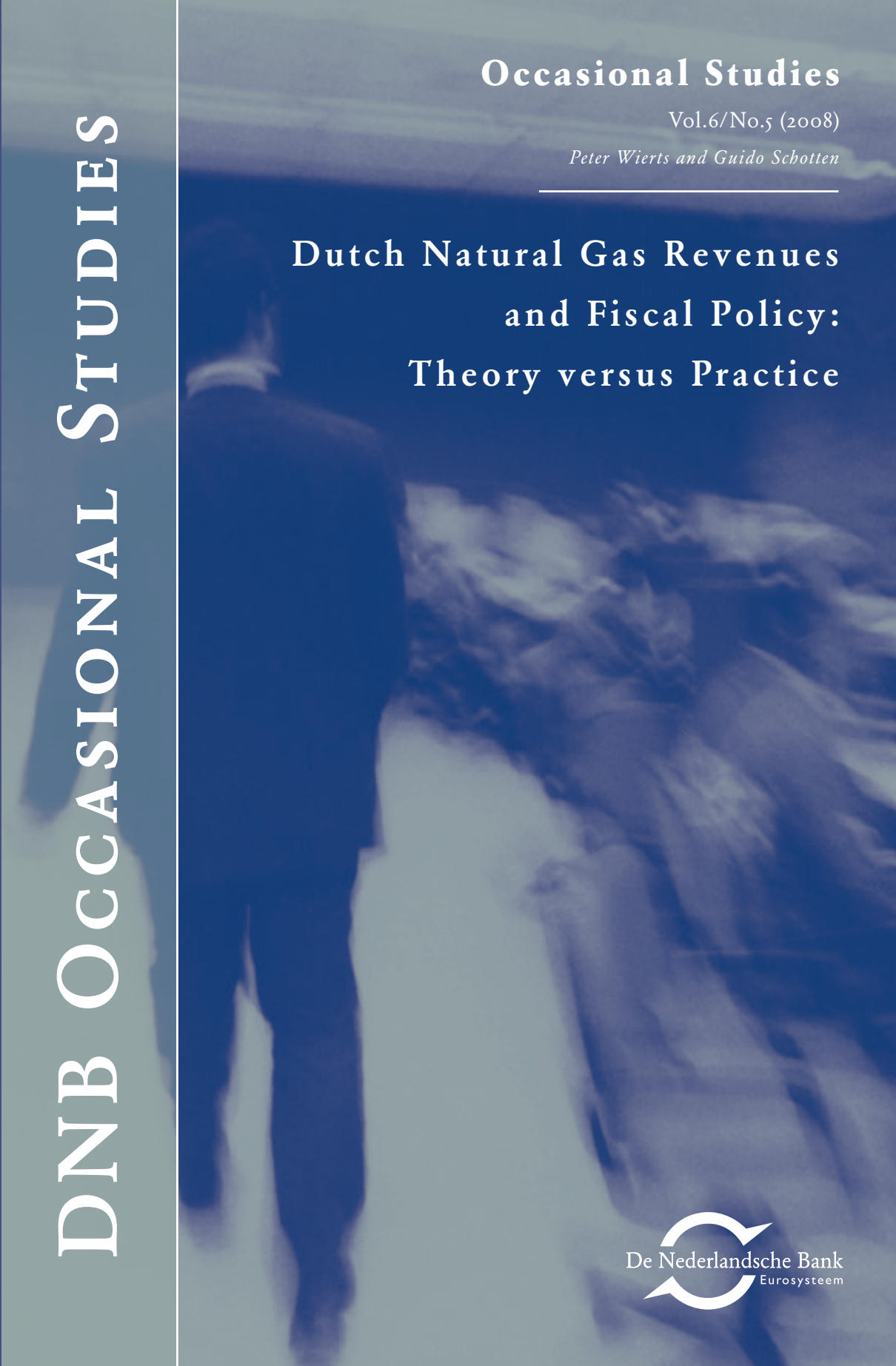
Peter Wierts and Guido Schotten

Dutch Natural Gas Revenues and Fiscal Policy: Theory versus Practice



De Nederlandsche Bank
Eurosysteem

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De Nederlandsche Bank
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Centrale bank en prudentieel toezichthouder financiële instellingen

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Dutch Gas Revenues and Fiscal Policy: Theory versus Practice

Peter Wierts and Guido Schotten[1]

Abstract

The Dutch government's revenues from natural gas fluctuate heavily and will dry up within several decades. According to the academic literature, only the permanent return on gas wealth should be included as income on the government's annual budget. This would prevent a deterioration in net wealth, and provide the budget with a stable source of income from which future generations can also benefit. On the basis of conservative estimates, it follows from our calculations that the Netherlands could count on a permanent annual flow of receipts of around EUR 2.5 billion. In practice, however, gas revenues are included directly in the budget, while a part is reserved for investment via the Economic Structure Reinforcement Fund (*Fonds Economische Structuurversterking*). Using gas revenues for debt reduction, higher spending or lower taxes are political choices made anew by every new government. Our estimation results for the period 1975-2007 show that of a 1% of GPD rise/fall in gas revenues, 0.8 percentage point goes to easing/tightening policy and 0.2 percentage point to an increase/decrease of the budget balance. In the light of the recent fluctuations in oil and gas prices, preserving the stock of wealth from natural gas resources should become more important for the budgetary treatment of gas revenues in the Netherlands.

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1 Introduction

The 49th item on the list of fifty items constituting the Dutch canon is: 'The natural gas reserves 1959-2030? A finite treasure'. Dutch gas reserves thus officially form part of what has been described as the entirety of important persons, texts, works of art, objects, phenomena and processes which together show how the Netherlands became the country it now is.[2] An important aspect of all this is how return on gas wealth is used. Experience suggests a dilemma here. On the one hand, it is desirable to preserve wealth by using gas revenues for investment in the Dutch economy and debt reduction. On the other, there is unabated political and social pressure to use our subterranean wealth for the many urgent policy needs. In the 1970s, for instance, gas revenues were used to build the welfare state; more recently, it was proposed that gas revenues be used to finance the fiscal costs of population ageing (Boonstra, 2008).

This study focuses on what we can learn from the literature about the optimal use of income from natural resources, and how this compares to the actual use of the Dutch gas revenues.[3] From this, recommendations on how to use gas revenues in the future follow.

The issue has become more relevant over the past few years. Rising oil prices have boosted income from natural gas extraction in the Netherlands. Since the turn of the century the natural gas sector's contribution to the Dutch budget has more than doubled, to 2.1% of GDP in 2008. Also, the coalition government has made new plans about the allocation of gas revenues, including a stable source of income for the Economic Structure Reinforcement Fund (Fonds Economische Structuurversterking or FES). It has been suggested that the gas revenues be used for debt reduction and that the interest costs thus saved can then be used to sustain the FES (Coalition Agreement 2007, p. 47). This study looks at the rationale behind the preservation of gas wealth and the form this should take.[4]

The remainder of this paper is organised as follows. Section 2 looks at the optimal use of revenues from natural resources such as oil and gas from a theoretical perspective. Section 3 describes how the Netherlands used its gas revenues before the FES was set up in 1994 and analyses the constraints imposed on the use of gas revenues by the current budgetary rules and the FES. The effects of the recent introduction of a stable source of income for the FES are also discussed. Section 4 presents our estimates of the influence of natural gas revenues on the budgetary policy pursued. Section 5 deals with the application of the principle of wealth preservation in practice. Conclusions are presented in Section 6.

2 Theoretical approach to optimal use of gas revenues

Gas revenues differ from regular income on the government budget in that they are exhaustible and subject to major uncertainty/volatility. As a finite and dwindling source of income, gas revenues will in due course have to be replaced by other sources of income or be followed by budgetary consolidation. This raises questions about the sustainability of the government budget and about intergenerational redistribution. In the literature about the optimal use of revenues from natural resources, it is often emphasized that income of this sort is a form of wealth and should therefore be treated differently from regular tax receipts (see, for instance, Barnett & Ossowski, 2002). From this perspective, revenues from gas extraction should not be seen as current income, but as a portfolio transaction entailing the transformation of capital in the shape of natural gas into financial wealth. This means that the government's financial position deteriorates if gas revenues are not either saved or used to repay public debt. Moreover, the value of future gas revenues is highly uncertain because it is unknown exactly when the gas reserves will run out and because oil prices are extremely volatile.[5] As it is not easy to distinguish between transitory and permanent price shocks, the budgetary implications of oil price movements are highly uncertain.

Given the exhaustibility and volatility of gas revenues, using these revenues immediately can lead to volatile domestic spending and a less than optimal intergenerational distribution. In the literature, this is often regarded as a problem of optimisation of inter-temporal consumption allocation. Intergenerational wealth maximisation leads to a permanent consumption rule, transforming gas wealth into financial wealth. Return on this wealth can be used to stabilise the level of public spending. This optimal consumption path follows from Friedman's *permanent income hypothesis* (PIH). In its simplest form, PIH states that the consumption of consumers and governments is determined by expectations about their long-term financial position, and that the optimal situation is one where consumption is kept constant over time. Applied to gas revenues, the optimal situation would be one where government consumption financed by gas revenues equals the return on the net present value of gas wealth (Segura, 2006). At zero population and productivity growth, the PIH implies the following rule concerning government consumption (*GC*) financed by gas revenues:

$$GC_{t+1} = GC = r \times \left[F_t + \sum_{i=0}^{I} \frac{T_{t+1+i}}{(1+r)^i} \right]$$

Here F_t is the value of the accumulated proceeds from the sale of natural gas at the end of the preceding year; T_i is the gas revenues anticipated by the government in period i (at constant prices); r is the discount rate assumed to equal the expected average real return on gas revenues and I is the number of years until gas reserves will be exhausted. Section 5 presents calculations made in accordance with this formula for the Netherlands.

Some might interject that the PIH approach does not allow for the fact that public spending is not directed at consumption only; it may also be used for investment, and thus yield social benefit. This means choosing between a financial form of wealth preservation and investment in the real economy. In reality, this choice need not be made at all, though. Investment theory shows that in principle any project with a positive social net present value should be carried out; whether or not to do so does not depend on the availability of revenues from natural resources. A trade off between a financial form of wealth preservation and investment in the real economy exists only when the government is subject to credit restrictions. The issue becomes relevant if socially profitable investment projects would not be carried out in case they are not financed by gas revenues. This will be the case more often in countries with a low initial capital stock and efficient or qualitatively sound public investment. A complex trade-off then arises between return on public investment and the price in the form of lower permanent expenditures.[6] However, the return expected to be earned on major public investment projects is often subject to considerable uncertainty. There is therefore a risk that politicians will use the money to finance projects which are insufficiently profitable (see also Van der Ploeg, 2006, and the Studiegroep Begrotingsruimte, 2006, for the Dutch experience).

In a system where gas revenues are regarded as wealth, they are not included in the annual budget.[7] Gas revenues are used for wealth preservation, such as debt reduction or the creation of a financial fund. Only permanent return on gas wealth (which is gradually being transformed from subterranean capital into financial wealth) is available for the budget. As a result, volatile oil prices do not translate into volatile domestic spending, the government's financial position does not deteriorate and the budget is given a perpetual source of income.

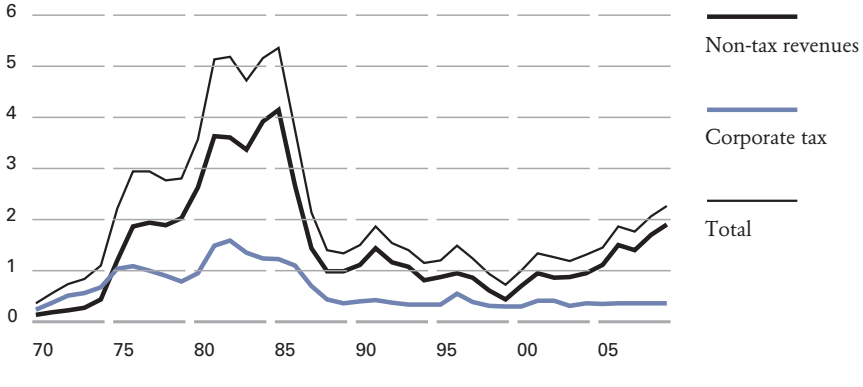
3 Natural gas revenues and the Dutch budgetary system

3.1 Experiences with natural gas revenues

Dutch natural gas revenues consist of non-tax revenues and corporate tax revenues. The non-tax revenues component, which on average makes up about two-thirds of total annual gas revenues in the period 1970-2006, consists of transfers to the state related to gas extraction rights and transfers to the state related to the profits realised on the gas extracted (Central Bureau for Economic Policy Analysis ['CPB'], 2005). Chart 1 shows the historical values of two categories of gas revenues from 1970 through 2007, as well as the estimates for 2008 and 2009 by the CPB. What stands out is the peak in gas revenues in the mid-1980s, as well as the resumption of the rise in gas revenues since the turn of the century. The estimates point to a further increase in gas revenues related to higher oil prices: in the Central Economic Plan for 2008, total gas revenues (i.e. the non-tax plus the tax components) for 2008 and 2009 are estimated at 2.1 and 2.2% of GDP (against an average 1.2% in the period 1994-2006).

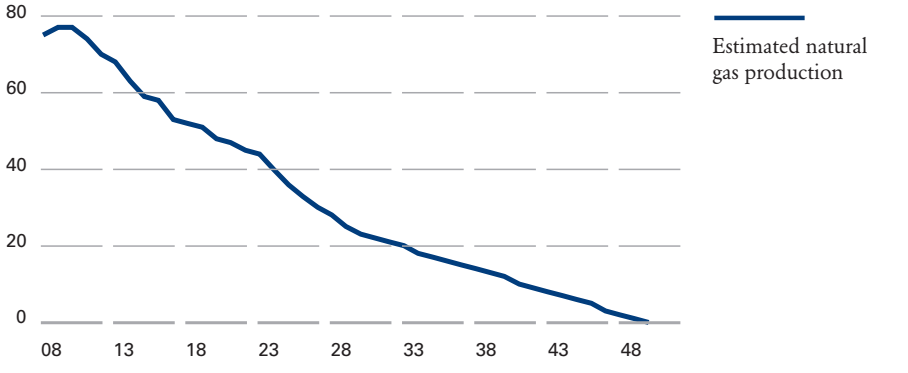
The rate at which gas extraction will decline in the years ahead is surrounded by

Chart 1 Gas revenues



Source: CPB.

Chart 2 Estimated natural gas production



Source: Combination of estimates by the Ministry of Economic Affairs, CPB and own calculations..

much uncertainty. Chart 2 gives an indicative estimate of future gas extraction volumes, based on data from the Ministry of Economic Affairs, the CPB and own calculations.[8]

3.2 The period until 1994

During the period before 1994, all gas revenues went straight to the government budget. In the 1970s, consumption of the surging gas revenues led to 'Dutch Disease', a term that not only referred to the pressure exerted by the higher gas revenues on the real exchange rate, but also to the derailment of the real economy and public finance. The literature on the symptoms of the 'Dutch Disease' often warns for the risk that a sharp rise in revenues from natural resources may encourage politicians to use the temporal income to raise the welfare state to a level that is unsustainable once the natural sources dry up (Van der Ploeg, 2006 and Gylfason, 2001). This is exactly what happened in the Netherlands in the 1970s. Minimum wages and social security benefits were raised substantially along with a relaxation of the allotment criteria. Public expenditure rose spectacularly, from 44% of GDP in 1970 to 61% in 1983. Although running up fast, the natural gas revenues could not keep up with the increase in public expenditure. As a result, tax increases were necessary, while at the same time public debt went up from 38% of GDP in 1977 to nearly 70% in 1984.

Although the derailment of the economy and public finance was also partly caused by the oil crisis and stagnant growth in Europe, gas revenues played a crucial role by masking how much the real economy and public finance were in fact deteriorating '*Almost simultaneously with the moments when the budget was hit by the*

recessions arising from the oil crises, an important solace presented itself by way of extra natural gas revenues. This temporarily obscured the seriousness of the budgetary situation. The problem of the sudden inflow of gas revenues was that it prevented the traditional warning signals (the current account of the balance of payments and the budget deficit) from turning red, thus leading many to think that the oil crises' effects were less harmful for the Netherlands than they were in reality. The extra natural gas revenues were mainly used for expenditure increases' (Wellink, 1987, p. 348).

3.3 Gas revenues and the budgetary system: the period 1994-2007

In 1994, the FES (Economic Structure Reinforcement Fund) and the Dutch fiscal rules of the so-called trend-based budgetary policy system were implemented. In this section, we analyse which preconditions the FES and the fiscal rules set on the use of gas revenues. These preconditions differ per gas revenue component, i.e. the component earmarked for the FES, the component not intended for the FES, and the corporate tax component. These components are therefore discussed separately.

The use of gas revenues: the FES part

According to the Act on the Economic Structure Reinforcement Fund, 41.5% of so-called non-tax gas revenues flow into the FES.[9] These resources are designated for investment projects of national importance meant to reinforce the economic structure. Investment projects break down into the following main categories: traffic and transportation, environment and sustainability, knowledge and innovation, environmental planning, and projects in preparation. In addition, the coalition government has made agreements (the Coalition Agreement of 2007) about the extension and new classification of the criteria, the main categories being: infrastructure, knowledge and innovation, sustainable energy, water management and environmental investment.

When the FES was founded in 1994, it was taken into consideration that instituting a fund for the allocation of specific resources carries the risk of disturbing the integral assessment of resources and expenditure via the central government budget. Despite this, the Cabinet decided to set up a separate fund, because in this way part of the gas revenues would be earmarked for nationally important investment projects that reinforce the economic structure (Explanatory Memorandum to the Act on the Natural Gas Revenues Fund, 1993). The objective was to compensate for political-economic factors that could lead to curtailment of the share of investment in public expenditure. Short-term cutback measures often affect investment since future investment projects are easily shelved compared to other expenditures, which are largely fixed. The consideration that the investment projects financed by the FES would not come about without the use of gas revenues therefore seems to have played a role in the founding of the FES (also see Section 2). The Explanatory

Memorandum also emphasises the consideration that subterranean capital proceeding from the Dutch gas reserves should be converted into above-ground capital. Furthermore, the issue of volatility (as raised in Section 2) is discussed. According to the Explanatory Memorandum, a budgetary fund makes it easier to cope with the relatively large uncertainties on the revenue side of the budget (Explanatory Memorandum to the Act on the Natural Gas Revenues Fund, p.2). An important principle of the fund in this context was that any positive balance of revenues in excess of expenditures could be carried forward to the next year.

As of 2008, the practice of feeding the FES with a fixed percentage of gas revenues was abolished, in conformity with the Coalition Agreement (2007). This change was primarily prompted by the problem posed by expenditure pressures following higher-than-expected natural gas revenues (see Studiegroep Begrotingsruimte, 2006, and the letter from the Minister of Economic Affairs and the Minister of Finance on the amendment of the Act on the Economic Structure Reinforcement Act, 2008). In the new system, FES investment will be financed by a fixed amount of gas revenues. However, for the 2008 FES budget no stable source of income was yet included, so that the expenditures actually determine what part of the gas revenues is allocated FES. As a result, the gas revenue percentages going to the FES are no longer fixed but variable. To gain insight into the new percentages, we calculate the share of gas revenues that will be allocated to the FES. Table 1 shows that, compared to the former system, the percentages will be approximately half of what they were before. This picture may change, of course, depending on the investment planned and the development of the natural gas revenues. Strikingly, also the percentage for 2007 is well below the norm. This is the result of the Cabinet's decision in 2006 to 'pre-finance' a EUR 1 billion reduction in the tax and premium burden on the EU budget via the FES. This example illustrates that the use of gas revenues is not only determined by the system's rules, but also by the political considerations of the moment. Another case in point is the so-called 'FES Bridge', which permitted the release of funds from the FES for spending through the regular budget (Study Group

Table 1 Percentages of gas revenues allocated to FES on the basis of FES budget for 2008

In million EUR

	2006	2007	2008	2009	2010	2011	2012
Gas revenues for FES budget for 2008	3321	1924	2120	2095	2025	1568	1716
Gas revenue estimate (non-tax)	8047	7150	9200	10400	9600	8700	8200
Gas revenue percentage (non-tax) to FES:	41.3	26.9	23.0	20.1	21.1	18.0	20.9

Source: calculation on the basis of the FES budget for 2008.

on the Budget Margin, 2006, p. 59). Therefore, to obtain an accurate picture of the way gas revenues are used, it remains necessary to analyse not only the formal rules of the game, but also the way in which these are implemented in practice.

Until 2007, when gas revenues came out higher than in the projections, the extra revenues would automatically flow to the FES. With the transition to a stable allocation of funds to the FES, these fluctuations will now flow to the regular government budget and will be treated as fluctuations in the non-FES part of the natural gas revenues.

Use of gas revenues: the non-FES part
The gas revenues are included in the budget margin calculations made by the CPB at the start of the Cabinet period (see Jansen, 2006, amongst others).[10] Thus, the budgetary system sets no clear preconditions for the non-FES part of the gas revenues: the use of these funds for a reduction in the tax and premium burden, higher spending or public debt reduction is a political decision made anew by every new Cabinet. Because of the integral assessment of funds and expenditure, it is not immediately clear how these choices have been made. In Section 4, we therefore try to obtain an indication via original empirical estimates.

Use of the corporate tax part of gas revenues
Gas revenues arising from corporate taxes are treated just like regular tax and premium income. They can be used to lower taxes and premiums, to increase spending, or to bring down public debt. In conformity with the general rules of the system and the philosophy of the automatic stabilisers, windfalls or shortfalls in these revenues must lead to fluctuations in the budget balance.

Findings regarding the use of gas revenues according to budgetary system
Our analysis shows that the principle of wealth preservation, as discussed in Section 2, only to a limited extent determines the way in which the Dutch budgetary system treats natural gas revenues. Before 1994, the principle of wealth preservation played no role whatsoever in the treatment of natural gas revenues. After 1994, however, wealth preservation was the leading motive for the gas revenue component expended via the FES. Another motive is the notion that part of the gas revenues could be used for reducing public debt. However, as a result of the integral assessment of resources and expenditure, the size of the contribution to the reducting of public debt cannot be retrieved. Most of the gas revenues are used to finance the current budget. This leads to criticism such as formulated by Wientjes (2008): 'Our natural gas revenues are still largely dissipated through consumption, by using these revenues to finance the current government budget.'[11]
Finally, we would point to the relation with the present Cabinet's target of a structural surplus of 1% of GDP in 2011. While previously part of the windfalls in the

total gas revenues would go to the FES, now all windfalls go to the budget balance. Windfalls in gas revenues do not enhance the sustainability of public finances, but they do bolster the structural balance, which only corrects for the business cycle. It follows that fluctuations in gas revenues lead to volatility in the structural balance, thus rendering this indicator less suitable as a medium-term target. It would therefore be consistent if the transition to stable fund allocations to the FES would be accompanied by defining the medium-term target in terms of the so-called 'robust balance' (which corrects for both the business cycle and natural gas revenues). Also, in this way consistency will be achieved with the sustainability calculations of the CPB, which are also defined in terms of the robust balance.

4 Empirical estimates[12]

We have seen that, all available funds and expenditures on the government budget are integrally assessed, and therefore we do not know to what extent fluctuations in the natural gas revenues have led to a change in the budget balance or to a policy response.

To get an impression of this, in this section we will make empirical estimates. We estimate a fiscal response function with the standard explanatory variables for the budget balance: the output gap[13] (to capture the response of the budget balance to economic fluctuations) and the lagged debt (the balance must respond to rising debt in order to guarantee sustainability).[14] The new element is that we do not take the primary balance[15] as an independent variable, but the 'non-gas balance', i.e. the primary balance minus the natural gas revenues. We correct the dependent variable for the natural gas revenues, as the fluctuations in the natural gas revenues may be considered exogenous and do not reflect a policy response (as assumed in the traditional specification). Fluctuations in the natural gas revenues, on the other hand, may lead to a policy response in expenditures or tax rates, as they increase or reduce the financial leeway. Therefore, we include gas revenues as an additional explanatory variable.

In conformity with the theory set out in Section 2, when gas wealth is preserved the 'non-gas balance' should be segregated from the development of the natural gas revenues; in that case the natural gas revenues have no effect on this balance (statistically insignificant coefficient). A negative coefficient would be an indication that the extra natural gas revenues do lead to a policy response by way of higher spending or lower taxation, and thus to a deterioration of the 'non-gas balance'. At a coefficient of -1, the policy response would be proportional: a 1% of GDP rise/fall in natural gas revenues leads to a deterioration/improvement of the 'non gas balance' by 1% of GDP.

The data of our estimates are taken from the CPB (natural gas revenues, output gap) and the National Accounts. The projection period is 1975-2007, because the output gap data are available from 1975 upwards. To keep the text readable, we will confine ourselves here to describing the most important estimation results as reflected in Table 2; a detailed explanation of our results – including diagnostic tests – can be found in the Annex.

In Table 2, we report the results using ordinary least squares (OLS), but also the

Table 2 Estimate of effect of gas revenues on the 'non-gas balance'.

	Dependent variable: primary balance excl. natural gas revenues (non-tax)	
	OLS	IV-2sls
Output gap	0.56	0.64
	(3.8)***	(2.9)***
Lagged debt	0.06	0.07
	(4.4)***	(3.6)***
Gas revenues (non-tax)	-0.78	-0.79
	(-2.6)**	(-2.4)**
Lagged dependent variable	0.17	0.12
	(1.0)	(0.6)
Constant	-2.26	-2.67
	(-2.2)	(-2.1)
Observations	*33***	*31***
Adjusted r-squared	*0.82*	*0.82*

Source: estimates with Stata on the basis of data from the National Accounts and CPB.
Note: the estimation method is OLS, or two-stage least squares; *, **, and *** indicate statistical significances of 10%, 5% and 1%; t-values or z-values (for IV projection) are between parentheses. As instrument variable for the output gap, output gaps lagged by one and two periods have been used.

results that we obtain when instrumenting the output gap, because of a possible reversed causality of the balance to the output gap (although the null hypothesis that the output gap is exogenous is not rejected; see Annex). Choosing this estimation method makes little difference for the results.

The baseline estimate confirms that our specification makes a better fit for the Netherlands than the standard specification from the literature. The explanation percentage ('adjusted R-squared'), which introduces a correction for the number of explanatory variables in the equation, is 0.64 in the traditional regression and 0.82 in our specification. All variables are statistically significant in this equation, except for the lagged dependent variable. The coefficient for the output gap of approximately 0.6 indicates that the balance fluctuates with the business cycle. The value found approximates the value of 0.55, which is commonly observed for the Netherlands. The coefficient of the balance's response to the lagged debt is somewhat high, considering that this coefficient usually varies between 0.01 and 0.05 (improvement of the balance by 0.01-0.05% of GDP as a result of a debt increase by 1% of GDP). The coefficient of -0.8 for the gas revenues is statistically significant with a p-value of 0.01. The value of the coefficient indicates that 1% of GDP higher/lower gas revenues leads to 0.8% of GDP in easing/tightening policy response.

We tested the stability of the coefficients in our model, because a number of events can be identified in advance when a structural break might have taken place. Such breaks followed on the introduction of the FES in 1994, the adoption of the Maastricht criteria in 1992 and the signing of the Wassenaar Accord in 1982. To make sure that nothing is excluded, we tested the stability of all coefficients for all years from 1980 up to and including 2000.

The data indicate that a structural break only occurred in 1991 (the F-test shows that, jointly, the coefficients for the second period deviate significantly from the earlier period). The t-tests indicate that this break specifically occurred in the coefficient for the lagged debt and the constant in the equation. We have therefore re-estimated the model, allowing a deviating value in the coefficient for the lagged debt and in the constant. The results are reflected in Table 3. For the period 1975-1990, the value of the coefficient for the lagged debt is 0.036, while the coefficient for the period 1991-2007 is 0.036+0.064=0.10. This higher coefficient for the recent period may be explained by the convergence criteria for debt and deficit as adopted by the Maastricht Treaty, and is consistent with an extra sustainability effort from

Table 3 Estimated effects of gas revenues on 'non-gas balance'.

	Dependent variable: primary excl. gas revenues (non-tax)
Output gap	0.70***
	(5.1)
Lagged debt (1975-1990)	0.036**
	(2.4)
Lagged debt*dum'91	0.064**
	(2.6)
Gas revenues (non-tax)	-0.84**
	(-3.0)
Lagged dependent variable	-0.05
	(-0.4)
Constant	-1.14
	(-1.1)
dum'91	-2.94
	(-1.9)*
Observations	33
Adjusted R-squared	0.87

Source: estimations with Stata on the basis of data from the National Accounts and CPB.
Note: the estimation method is OLS; *, **, and *** indicate statistical significances of 10%, 5% and 1%; t-values are between parentheses.

the early 1990s. The coefficient for the effect of gas revenues slightly increases to -0.84, while its statistical significance also increases somewhat.

The stability tests gave no indication of a structural break in the coefficient of the gas revenues. The absence of a structural break in 1994 (also see the Annex) could be related to the low number of observations available for the period 1994-2007. It should therefore not be ruled out that, several years from now, a structural break related to the introduction of the FES in 1994 will be observable, since by then more data will be available.

In conclusion, our estimates are consistent with the picture emerging from Section 3: the principle of wealth preservation has only been applied to a limited extent for the way in which the Netherlands has used its natural gas revenues. Fluctuations in gas revenues have led to a statistically significant and quantitatively relevant policy response.

5 Wealth preservation in practice

Not only in theory, but also in practice, the idea of wealth preservation has received increasing support over the past few years. A case in point is Norway, where oil revenues flow to a financial fund and the return flows to the Treasury. The objective of this fund is to preserve national wealth and to protect the domestic economy against strong fluctuations in oil revenues. Another example is that of Sao Tomé and Principe, set to become an oil-producing country (after 2012). This currently poor developing country has asked the IMF how to deal with its future oil revenues. In line with the permanent income hypothesis, the oil revenues will be saved in a fund; the estimated return on the cash value of the total oil stocks can be used for spending (Segura, 2006).

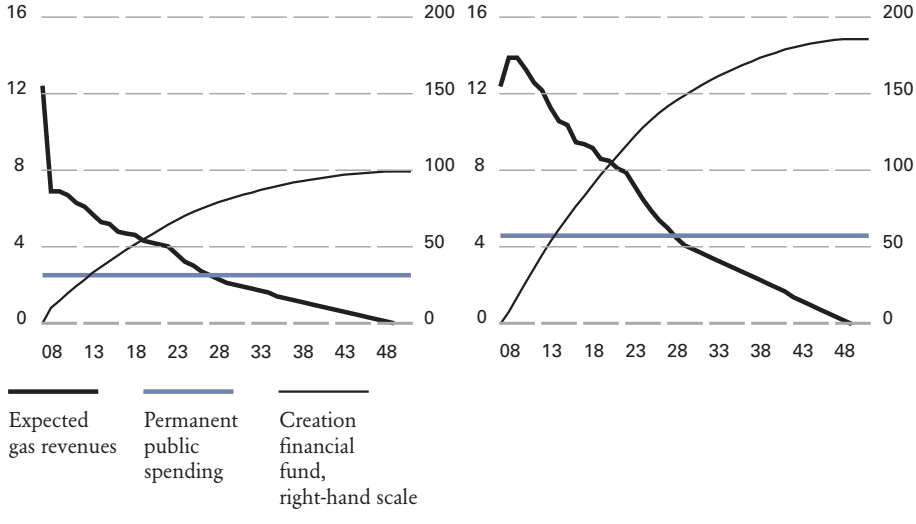
The difference between these countries and the Netherlands is that the Dutch gas revenues account for a smaller share of GDP. Still, the principles of wealth preservation and the prevention of fluctuations hold for the Netherlands as well. Currently, approximately one-third of the original gas stock has not yet been extracted, so that the remaining gas revenues are still substantial. The depletion of gas revenues will therefore have a significant impact on the sustainability of public finance. In addition, fluctuations in the gas revenues of 0.5% of GDP or more are not negligible when compared to the usual cyclical fluctuations in the budget balance.

To what level would permanent expenditures rise if the Netherlands were to follow the example of other countries and adopt the principle of wealth preservation? By making a simple calculation we can show how application of the permanent income hypothesis would work out for the Netherlands.[16] For future gas extraction, we use the estimation from Chart 2. We assume an oil price of EUR 60 per barrel for 2008 (as estimated in the CEP 2008), and two scenarios for the remaining period: an unchanged real oil price (of EUR 60 in 2008 prices) and a conservative scenario (with a real oil price of EUR 30). We assume a linear link between gas extraction and oil prices on the one hand, and gas revenues on the other (on the basis of the CPB's medium- and long-term estimates for the period 2007-2011).[17] The real discount rate and the fund's expected real return are set at 2.5%. We can then calculate optimal permanent public spending on the basis of the formula in Section 2.

At a constant real oil price of EUR 60, optimal permanent public spending will be EUR 4.6 billion per annum. By the time the gas reserves have been depleted in 2050, a financal fund of EUR 186 billion will have been accumulated (Chart 3). In the

Chart 3 Creation of financial fund and permanent public spending according to PIH rule

EUR billion (real prices 2008)



Explanatory note: Assumption 2008: EUR 60 per barrel; 2009 and later: EUR 30 and 60, respectively, per barrel.
Source: Combination Ministry of Economic Affairs, CPB and authors' estimates.

conservative scenario, with a real oil price of EUR 30 as from 2009, permanent public expenditures will be EUR 2.5 billion, while the fund accumulates to EUR 99 billion in 2050. Given the major uncertainties surrounding future gas revenues, it would be advisable to base permanent public spending on a conservative scenario. This permanent return will constitute a stable and continuous source of income for the government budget.

6 Conclusion

Our study suggests that an important part of the Dutch gas wealth has been used up since the gas stock was first discovered. In line with the literature about the optimal use of income from natural resources, the Netherlands should apply the principle of wealth preservation to its treatment of gas wealth. This would prevent the sustainability of the government's financial position from deteriorating and create a stable source of budgetary income. Given the expectation that the Netherlands can benefit from gas revenues for another thirty years, it is still not too late to preserve the remaining gas wealth for future generations. In recent years, the importance of keeping gas revenues away from the regular budget has increased because of the strong fluctuations in oil and gas prices. There is a risk that transitory proceeds will be used for structural policy, because the budget system includes natural gas revenues fully in the budget margin, as calculated by the CPB at the start of each Cabinet's term of office.

The Cabinet has proposed an amendment of the act governing the FES which entails that a stable source of income be created on the basis of the permanent return on gas wealth; this income can, however, be decreased by a discretionary decision (see the letter from the Minister of Economic Affairs and the Minister of Finance about amendment of the Act on the Economic Structure Reinforcement Fund, 2008). It is positive that the principle of wealth preservation will thus figure more prominently in the treatment of gas revenues than has been the case so far. The logical next step would be for all natural gas revenues to be kept away from general resources on the government budget.

The next question, beyond the scope of this study, is which form the wealth preservation should preferably take. The remaining gas wealth could be used for investment, for the creation of a Dutch Sovereign Wealth Fund or for reduction of public debt. More research is needed for a deeper understanding of the pros and cons of these different policy options.

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Annex Explanation of estimation results

The standard specification of the fiscal response function is (zie inter alia Bohn, 1998, IMF, 2004, or the literature survey in Wierts, 2007):

$$pb_t = \alpha gap_t + \beta debt_{t-1} + \gamma pb_{t-1} + C + \varepsilon_t$$

where *pb* is the primary balance as a percentage of GDP, *gap* the output gap, *debt* the public debt as a percentage of GDP, *C* a constant, ε the error term and subscript *t* the time dimension.

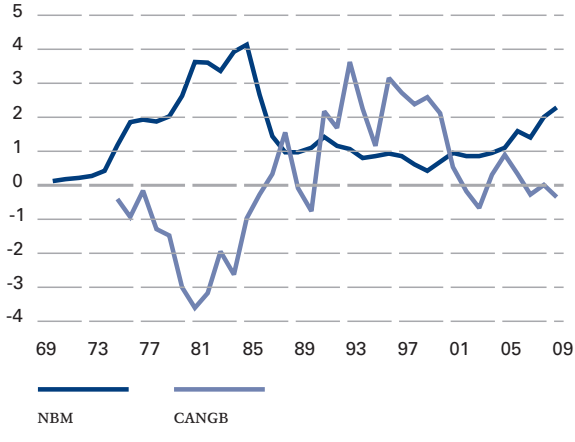
What is new about our approach is that, instead of the primary balance, we use the non-gas balance as dependent variable, i.e. the primary balance minus the gas revenues. The rationale follows from the literature study of Section 2. In the event of wealth preservation, the gas revenues are used for redeeming the national debt or to feed a financial fund. The non-gas balance then becomes the most important guideline for budgetary policy. Put differently: in the event of wealth preservation, the non-gas balance should not systematically respond to the actual gas revenues. Such response is evident, of course, if gas revenues result in a policy response by way of higher spending or lower taxes and premiums. The estimated coefficient will be negative in that case. Therefore, our baseline specification is:

$$ngpb_t = \alpha gap_t + \beta debt_{t-1} + \kappa gasrev_t + \gamma ngpb_{t-1} + C + \varepsilon_t$$

where *ngpb* stands for the primary balance corrected for gas revenues and *gasrev* for the gas revenues.

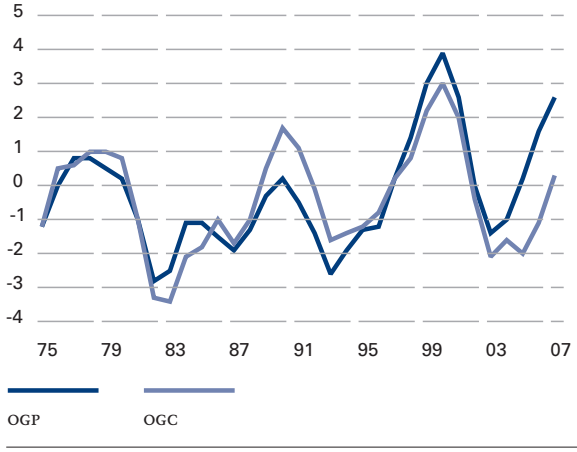
Before showing our estimates, we want to obtain a visual impression of a possible relation between the budgetary policy pursued and the gas revenues. Therefore, we correct the non-gas balance for the output gap by using the usual method and assuming the usual sensitivity of 0.55 also used by the European Commission (i.e. non-gas balance minus 0.55 times the output gap). Correcting for interest payments, gas revenues and the business cycle, this series could be referred to as the cyclically-adjusted non-gas balance. This variable, which can be interpreted as a proxy for the budgetary policy pursued, is set alongside the gas reserves (see Chart 4), suggesting a negative correlation.

Chart 4 Gas revenues and the 'cyclically-adjusted non-gas balance' (CANGB)



As the results may be sensitive to the specific output gap measure used, we run the regression using the output gap as calculated by the CPB and the output gap as calculated by the European Commission. It turns out that the fit with the output gap according to the CPB is much better, both in the traditional reaction function and in our adjusted specification. The explanation percentage (R-squared) for our specification is 0.78 if we use the output gap as calculated by the European Commission, and 0.84 if we use the output gap according to the CPB. Moroever, the output gap according to the CPB is statistically significant (p-value 0.001), while the output gap according to the Commission is not (p- value: 0.14). As reflected in Chart 5, the output gap as calculated by the CPB shows a more pronounced pattern

Chart 5 Output gap according to European Commission (OGC) and CPB (OGP)



than that of the Commission, as well as a more plausible development for the more recent years. Therefore, we will henceforth use the output gap as calculated by the CPB. It is important to note that our findings regarding the effect of the gas reserves hardly change if we use the output gap according to the Commission instead of the one according to the CPB. If we use the output gap according to the Commission, we obtain a natural gas revenue coefficient of -0.73 (against -0.78 in the base estimate) and a statistically significant p-value of 0.02.

Subsequently, we perform our baseline estimate (see Table 2 in Section 4). We test for heteroscedasticity, via the 'Cook-Weisberg test', and autocorrelation, via the 'Breusch-Godfrey test'. Neither test rejects the null hypothesis of no heterscedasticity/ autocorrelation, with p-values of 0.40 and 0.27. These results are confirmed when we estimate the model with and without the 'White standards errors' that correct for heteroscedasticity and autocorrelation. The changes in the standard errors occurring during this estimation are negligible. Finally, we analyse the probability distribution of the residuals by means of the skewness/kurtosis test for normality. The p-value found being 0.78, the null hypothesis of normality of the residuals is not rejected.

To test if the output gap is endogenous (i.e. the budgetary policy may on its own influence the business cycle), we perform the Durbin-Wu-Hausman test. As instrument variable we use the output gap lagged by one and two periods. At a p-value of 0.48, the exogeneity of the output gap is not rejected. However, we decide to also report the results of the test for which the output gap is instrumented with its lagged value, this being a common estimation method in the literature. As indicated in Table 2, this makes little difference for the eventual results.

The next step is to test the stability of the coefficients in the regression via the so-called Chow test. For this purpose, we multiply all variables by dummies for the years 1980-2007, 1981-2007 and so on, up to and including 2000-2007. Then, we add interaction terms of these dummies including all variables and the dummy itself (to identify any structural break in the constant). Subsequently, we use an F-test to determine whether the coefficients for the later period deviate significantly from those found for the earlier period. This only turns out to hold for 1991, where the structural break is attributable to the coefficient of the lagged debt and the constant. In the main text we therefore report results that permit a deviating value for the coefficient of the lagged debt and the constant.

For the coefficient of the gas revenues we do not find a structural break. For 1994 (the year in which the FES was introduced), the change in the gas revenue coefficient is far from significant (p-value of 0.94), while also the change in the value of the coefficient is minor (-0.78 for the natural gas revenues in the period up to 1994, and -0.70 for the later period). However, as stated in the main text, ideally more observations should be available to enable accurate measuring of any structural break by the FES.

Notes

1 The authors work at De Nederlandsche Bank's Economic Policy and Research Division. They wish to thank Henk Brouwer, Michiel van Goor, Jan Kakes, Rocus van Opstal, Job Swank, Cees Ullersma and Nout Wellink for useful comments.
2 See De Canon van Nederland at http://entoen.nu/.
3 Interestingly, the literature has focused on the FES over the past few years, but not on the (larger) other part of natural gas revenues that forms part of the goverment budget.
4 The question how fast the natural gas stock should be extracted is beyond the scope of this study; for our purposes, this rate is regarded as a given on the basis of the available estimates.
5 The gas prices are linked to oil prices with a lag.
6 See, for example, Takiza, Gardner and Ueda (2006). Their theoretical model shows that, during the transition to the steady state, it may be beneficial to accelerate the transition by investing part of the wealth from natural resources. The advantages of a speedier convergence towards the steady state must outweigh the costs of permanently lower spending in the steady state.
7 According to ESA95 rules (European System of Accounts), gas revenues are included in the EMU balance. Including gas venues in the budget is, however, a policy choice.
8 Earlier estimates run to 2030. We assume that from 2031 upwards gas extraction will linearly decline to nil in 2050 (the year in which the CPB assumes that the gas extraction will stop, see Van Ewijk e.a., 2006).
9 The percentage of 41.5% was introduced in 1999. Before that, natural gas revenues allocated to the FES used to be derived from the export volume exceeding the natural gas sales plan of 1990.
10 The budget margin calculations estimate the budget balance that would occur if the policy remained unchanged, on the basis of the medium-tern growth scenario of the CPB. This budget margin can subsequently be used for a reduction in taxation and social insurance contributions, an expenditure increase or public debt reduction. The degree to which any of these effects are realised is of course for the Cabinet to decide.
11 It may be added that public expenditure does not always qualify as consumer spending. Cases in point are expenditure in the field of education (investment in human capital) or investment via the Infrastructure fund.
12 This version contains an update of the calculations of an earlier version of this study. The explanation of the projections in the Annex was expanded. The main conclusions of the empirical projections and policy recommendations do not change.
13 The difference between actual and potential GDP, as a percentage of potential GDP.
14 See Bohn (1998) for an early case, and the IMF (2004) or Wierts (2007), among others, for recent cases.
15 I.e. the EMU balance excluding interest payments, because this balance better reflects the policy response.
16 To this end, we used the PIH formula for government consumption from Section 2. This formula assumes zero population and productivity growth.
17 In line with the advice of the 'Werkgroep Actualisatie Discontovoet'.

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