INDEX-LINKED BONDS

Results of a study into the features of index-linked bonds, viewed from the perspective of the Dutch State

Working Group on the Budget in Real Terms:

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Dutch Central Bank

Netherlands Bureau for Economic Policy Analysis

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1. Executive Summary

This report of the Working Group on the Budget in Real Terms addresses three questions as phrased in the instructions to this working group. These questions concern the significance of inflation linked bonds for the government budget (size and stability of interest costs and EMU balance) and the demand from pension funds for inflation linked bonds.

1.1. Key points

1. The interest rate on inflation linked bonds is expected to be lower than the interest on nominal bonds with an identical term to maturity.

2. Apart from their size, the variability of the interest costs in the budget is another relevant factor. Whether inflation linked bonds result in greater variability of the interest costs depends on whether the interest costs are measured in nominal or in real terms. For nominal interest costs, inflation linked bonds by definition entail a greater degree of variability than nominal bonds, while this is exactly the reverse where real interest costs are concerned. The present debt policy framework in which the EMU balance is the key parameter for budget policy, focuses on the nominal interest costs. From a long-term perspective, aiming at sustainability of government finances, an approach based on the real interest costs would be more appropriate.

3. Within the present debt policy framework, which focuses on the nominal interest costs and their short-term variability, inflation linked bonds are less attractive than issuing short-term bonds. This is because the ratio between size and variability of the nominal interest costs is more favourable for short-term bonds than for inflation linked bonds.

4. The relationship between shocks to the interest costs and other economic shocks is an important factor for the stability of the EMU balance. In general, shocks to the interest costs are relatively small in comparison with other shocks to the EMU balance, also where debt financing through inflation linked bonds is concerned. Calculations by the Netherlands Bureau for Economic Policy Analysis (CPB) show that inflation linked bonds yield a favourable relationship with other shocks, which gives them a stabilising influence on the EMU balance (hedge). In practice, short-term bonds may also yield a certain hedge. Because of the shorter term, however, this hedge will entail greater variability of the interest costs in the future. In both cases, the relationship (hedge) is certainly not perfect. For this reason, the absolute extent of the variability in the interest payments is important as well.

5. It is sometimes argued that the interest costs associated with the issue of inflation linked bonds are a better fit to the real expenditure framework used in Dutch budgetary policy than the interest costs associated with the use of nominal bonds. The argument runs as follows; because the

expenditure framework is adjusted for inflation, all expenditure items that are part of this framework should also move one-on-one with inflation. Inflation linked bonds must thus be a perfect match since they move one-on-one with inflation. The argument confuses the inflation-sensitivity of the stock of debt with the inflation sensitivity of the (flow of) interest cost. Even in the case of nominal funding, the rise in interest costs as a result of a 1 percentage point increase in inflation would be much larger than the 1% price adjustment that would apply to the real expenditure framework. The use of inflation linked bonds would cause an even larger discrepancy between the inflation-sensitivity of the framework and that of the interest costs.

6. Issuance of inflation linked bonds may contribute to prosperity in that it eliminates a form of market failure. For the pensions market, inflation linked bonds are a welcome instrument in order to cover inflation risks and increase the diversification possibilities. In this way, inflation linked bonds may contribute to the stability of the pensions sector, thereby contributing indirectly to stable government finances.

The overall assessment of inflation linked bonds depends on the weight attached to the various aspects. In conformity with the terms of reference, the working group is not expressing an opinion on this point.

1.2. Background

Inflation linked bonds cheaper?
The interest on inflation linked bonds is expected to be lower than the interest on nominal bonds with an identical term to maturity. The interest rate gap consists of two components, the inflation risk premium and a liquidity premium. The inflation risk premium is charged because creditors of nominal debts demand compensation for the uncertainty as to whether the bond is inflation proof. Although the expected inflation is incorporated in the nominal interest rate, the actual outcome is uncertain and depends on the inflation realised. Estimates of the size of the inflation risk premium vary and range from 0.1 to 1 percentage point. The CPB pension study applies a premium of ½ percentage point. Based on data collected by countries such as France and the UK, the Agency has calculated the maximum interest rate gap at 0.45 percentage point, which also includes the liquidity premium. The latter premium depends especially on the size of the market. Under the current market conditions, an index bond linked to the Dutch CPI obviously carries a slightly higher liquidity premium than a bond indexed to the euro CPI.

A lower interest rate does not necessarily mean that inflation linked bonds are “cheaper”, however. After all, the interest rate gap primarily constitutes compensation for the risk. Eventually, the valuation by the taxpayer will be the decisive factor. A more pragmatic approach usually looks at the size and significance of the interest costs for the EMU balance, as long as the latter is regarded as the key parameter for the budget policy.

Nominal or real definition of the interest costs

In addition to the price of debt, the variability of the interest costs is also a relevant factor. Whether inflation linked bonds contribute to stability in the budget depends on whether the interest costs are measured in real or in nominal terms, i.e. with or without the effect of inflation on the real value of the national debt. Traditionally, the government's financial position is measured against the size of the EMU balance, with a nominal definition of the interest costs. In recent years, attention has also been paid to the sustainability of government finances in the long term. Hereby the financial position is measured against the real financial position of the government in relation to the expected future income and expenditure (see, for example, the work of the EPC Working Group on Ageing). In this context, the interest costs measured in real terms are a better reflection of the government's position.

Present funding policy objective

The present funding policy objective is defined as *funding in order to refinance the current national debt and finance the deficit at the lowest possible cost subject to an acceptable degree of risk as regards the fluctuations in the budgeted interest costs*. This concerns the nominal interest costs. The working group has examined whether extending the State's range of instruments by inflation linked bonds would make debt financing more efficient. This analysis shows that – within this objective – issuing inflation linked bonds would not be cost effective for the State. Combinations of treasury notes and nominal 10-year bonds would offer a more favourable ratio between nominal interest expenditure and the risks to the budget.

Inflation linked bonds and variability of the EMU balance

Inflation linked bonds are expected to constitute a certain hedge for inflation shocks. In this way, the variability of the EMU balance will be reduced. In general, a high rate of inflation goes hand in hand with a favourable position of the primary balance. As the interest payments on inflation linked bonds also bear a positive relation to the rate of inflation, these will have an absorbing effect on shocks to the EMU balance. This relationship (the covariance) is not perfect, however. For this reason, the absolute extent of the variability (the variance) in the interest payments is important as well. As long as the nominal interpretation of interest payments continues to play a part, restricting the share of inflation linked bonds within the total debt portfolio is obvious. In principle, the variability of the EMU balance offers a better point of departure for capping than the current ceiling, which restricts the variability of the interest costs. Short-term bonds also offer a certain hedge, provided that the short-term interest rate follows the rate of inflation. However, the short term to maturity entails greater uncertainty about future interest payments.

Interest costs and the real expenditure framework

It is sometimes argued that the interest costs associated with the issue of inflation linked bonds would fit the real expenditure framework used in Dutch budgetary policy better than the issue of nominal bonds. The real expenditure framework is regularly adjusted for changes in the inflation rate. If inflation were to increase by 1 percentage point, all expenditures within the framework are

allowed to increase in size by 1 percent as well. The argument that inflation linked bonds best fit this framework because they too are denominated in real terms, confuses the inflation-sensitivity of the stock of debt with the inflation-sensitivity of the interest costs. When funded entirely through inflation linked bonds, not only the flow of coupons but the entire stock of debt is inflation-sensitive. That the stock of debt responds one-to-one to changes in the inflation rate does not imply the same inflation-sensitivity for the flow variable; the interest costs in the budget. As the interest costs are much smaller than the stock of debt, an increase in the costs of 1% over the stock of debt implies a much larger percentage increase in the interest costs. As long as only nominal bonds are used, the inflation-sensitivity of the stock is limited to the share of debt that is refunded each year (and only to the extent that inflation feeds through to the interest rate). Even in this case, the interest costs would increase by substantially more than 1% if inflation rose by 1 percentage point, given that the share of debt that is refinanced each year is generally much larger than the interest costs. The use of inflation linked bonds would amplify the response of interest costs to inflation, leading to an even larger discrepancy between the adjustment of the framework and the rise in interest costs.

Inflation linked bonds and pensions sector

Issuance of inflation linked bonds may contribute to prosperity in that it eliminates a form of market failure, i.e. the absence of a market for inflation-proof securities. This is of particular importance in an ageing society with growing pension savings. Total equity of the Dutch pension funds already exceeds 125% of gross domestic product and will grow considerably in the future (see CPB pension study, 2004). This means that the proportion between contribution base and pension commitments will become increasingly distorted, so that the effect that shocks will have on the equity position will require increasingly large changes in contributions or claims. Greater volatility in contribution rates may cause disruptions in the labour market, while it will also affect government finances via the deferred taxation and the contributions to the General Pension Fund for Public Employees (ABP). Uncertainty about the level of future pension benefits, moreover, will have a direct negative effect on prosperity.

The working group has examined the interest and potential motives of pension funds in taking out inflation linked bonds. The working group was given the impression that pension funds' interest has increased in recent years. In this connection, it should be pointed out that pension funds currently aim for matching to a limited extent only and use inflation linked bonds mainly as a diversification instrument. The incentives provided by the new Financial Reference Framework to aim for better matching are not particularly strong either. As a result, the demand for inflation linked bonds on the part of pension funds will be smaller than might be expected as part of a matching strategy. Nevertheless, a sufficient demand for inflation linked bonds is expected even in the current circumstances. The picture may improve considerably in the future if pension funds were to alter their course and focus on matching.

2. Introduction

2.1. Why inflation linked bonds?

Various reasons are conceivable as to why countries issue inflation linked bonds. The grounds on which countries have issued such bonds can be summarised as follows.

Credibility

- A number of countries used inflation linked bonds to reinforce their anti-inflation policy. To the extent that the market underestimated the success of this policy, the issuance of inflation linked bonds proved beneficial for these countries (Canada, UK, Sweden);

ALM considerations:

- The ALM approach starts from the assumption that temporary shocks lead to uncertainty, and that the government can contribute to welfare maximisation by absorbing such shocks (see also box 4.1). In this approach, there are three ways in which the debt portfolio may have a stabilising influence (in either nominal or real terms), i.e. (i) for the economy as a whole, (ii) for the government balance sheet or budget (hedge), or (iii) only for those tangible and intangible assets that generate cash flows. Despite the obstacles experienced in the practical application, the decision of some countries to issue inflation linked bonds was prompted partly by such ALM considerations (New Zealand, Canada).

Business case

- In many countries, the decision to issue inflation linked bonds was inspired by the expectation that this would enable cost-effective debt financing (Australia, Canada, France, Greece, Italy, Japan, Poland, UK, US, Sweden). Primarily, issuance of real debt would mean realisation of the inflation risk premium. In addition, issuance of inflation linked bonds could make the whole national debt more attractive to investors. Furthermore, costs could be saved if an extra instrument was used to finance a sizeable debt. In New Zealand, cost effectiveness was a precondition for the issuance of inflation linked bonds. As it was no longer satisfied in recent years, issuance was discontinued. In France, relevant factors included the consideration that issuance of inflation linked bonds was indispensable in order for the country to acquire benchmark status in the European market.

Market demand

- Countries indicate that they issue inflation linked bonds in order to meet the demand for such bonds in the market (Australia, Canada, France, Greece, Poland, UK). Investors use the instrument as insurance against inflation or in order to diversify their portfolio.

Measurement

- Some countries also advance arguments of statistical nature. For example, inflation linked bonds provide an indication of inflationary expectations in the market (Canada, Japan, UK, US, Sweden).

A number of reasons (such as reinforcing the anti-inflation policy or financing a sizeable debt) do not apply to the Netherlands. However, some other reasons may certainly be relevant. The focus of this report is on answering the three questions as originally phrased in the instruction to the working group:

(i) do inflation linked bonds offer a hedge against the inflation risk in the budget, in other words: do they contribute to the stability of the EMU balance;
(ii) is there a business case for inflation linked bonds, in other words: do they offer a better risk/cost ratio than nominal bonds; and finally
(iii) what is the need for inflation linked bonds on the part of pension funds.

Independently of the answers to the above questions, the issuance of inflation linked bonds may have a positive external effect on the economy as a whole. Inflation linked bonds enable pension funds to cover themselves against unexpected inflation shocks. This may contribute to the stability of the pensions sector. The working group has not examined to what extent issuance of inflation linked bonds may have a positive external effect on the Dutch economy, although the report contains a brief exploration of the subject.

2.2. What are inflation linked bonds and which inflation index is involved?

The definition of an inflation linked bond as applied in this report is consistent with the market convention, i.e. with the inflation linked bonds as issued by, for example, the US and France. These inflation linked bonds pay a real coupon over a principal sum that increases in accordance with the rate of inflation. The nominal (interest) expenses of such a bond are indexed to the rate of inflation. If in any year the rate of inflation is 1% point higher than originally estimated, furthermore, the (interest) expenses will increase in that particular year by 1% of the value of the outstanding inflation linked bonds.[1]

The working group focused on bonds linked to the *Dutch* consumer price index (CPI). A role for inflation linked bonds as a hedge against the inflation risk in the budget will be most likely if a link to a Dutch price index is taken as the starting point. Pension funds, too, prefer a link to a Dutch price index, both when inflation linked bonds are used to match indexed commitments or ambitions and when they are used for the purpose of diversification. On the other hand, the link to a Dutch rather than a European index will raise the liquidity premium payable by the State. This is because the market for inflation linked bonds linked to a Dutch price index is less liquid than the market for inflation linked bonds linked to a European index.

[1] The higher repayments to be made in the long term in the event of an inflation shock will be recorded as interest costs in the year in which this obligation arises. An inflation shock will also cause a slight increase in the interest costs in subsequent years, because the contracted real interest will be paid on a higher principal value of the indexed debt. However, this effect on the interest costs will be limited in quantitative terms.

2.3. Structure of the report

This report is structured as follows. Chapter 3 sets out the results as regards the question whether the issuance of inflation linked bonds contributes to the stability of the EMU balance. Chapter 4 addresses the question as to whether there is a business case for inflation linked bonds. Chapter 5 deals with the demand for inflation linked bonds on the part of the pension funds. In addition, this chapter explores the potential positive external effects of the issuance of inflation linked bonds on the economy as a whole.

3. Hedge: Do inflation linked bonds contribute to the stability of the EMU balance?

The central question in this chapter is whether the issuance of inflation linked bonds results in greater stability of the EMU balance.[2] For the State, inflation linked bonds become more expensive as inflation increases. This causes a rise in (interest) expenditure. This implies that if, in the absence of inflation linked bonds, the budget improves as inflation increases, inflation linked bonds will provide a hedge against the inflation risk in the budget. Conversely, the budget will in this case offer room for the fluctuation in interest costs resulting from the issuance of inflation linked bonds. This chapter describes the results of a study into the relationship between the budget and the rate of inflation. In addition, there is a brief discussion of fluctuations in interest costs in relation to the public spending framework.

Box 3.1: Real or nominal terms: EMU balance and inflation linked bonds

Whether inflation linked bonds contribute to stability in the budget partly depends on whether policy is based on a real or nominal budgetary framework. In a system in which the government's financial position is measured in nominal quantities, nominal debt as a rule contributes more to the stability of the budget, while inflation linked bonds have a greater stabilising effect if the financial position is approached in real terms. The reason for this is simply that inflation linked bonds by definition have a fixed real cost, while the real cost of the nominal debt depends on the realised price level. The choice between a real and a nominal approach falls outside the subject area of this working group. This choice depends on the government's objectives. The report at hand only addresses the significance of this policy framework for the choice between nominal and inflation linked bonds.

The government's financial position is often measured against the size of the nominal EMU balance. In addition, the long-term sustainability of government finances also plays a role. In view of the ageing of the population, various studies have been performed with regard to the long-term government finances. Hereby the financial position is basically measured against the real financial position of the government in relation to the expected future income and expenditure (see, for example, the work of the EPC Working Group on Ageing). The two approaches may be complementary. From long-term sustainability calculations, the latest Study Group on Budgetary Policy distilled a standard for the nominal EMU balance in the short and medium term.

In a long-term framework, a real approach of the government's financial position would be self-evident. After all, this will involve the balance between real income and real expenditure. In that case, unexpected shocks may be absorbed by aligning the nature and term of the debt as much

[2] Since the introduction of EMU, the contribution of debt management to the stabilisation of the EMU balance takes centre stage in academic literature on debt management. In practice, however, the possibility of a hedge is not used as an argument for issuing inflation linked bonds. This conclusion is drawn, for example, by Donna Leong (1999), "Theory and

as possible with the expected future developments in the real funding need. Inflation linked bonds would then be an obvious instrument.

In the short term, the EMU balance plays an important part. A relevant point in this connection is that there are two ways of measuring the EMU balance: one based on the nominal interest costs and one based on the real interest costs. The latter concept is more in keeping with the long-term framework of sustainability, because it measures the changes in the debt, adjusted for the inflation-related redemption of the debt. However, the nominal EMU concept predominates at present, and is also embedded in the Pact for Stability and Growth.

An important objective of the government's funding policy is restricting the volatility of interest costs. This is relevant because unexpected shocks in the interest costs will make the EMU balance more difficult to predict and therefore more difficult to control. Unexpected shocks in the interest costs are undesirable, certainly in times when the actual EMU balance is close to a particular ceiling (e.g. - 3% of GDP). Chapter 4 will discuss the significance of this risk framework for the business case regarding the issuance of inflation linked bonds.

3.1. Inflation linked bonds and stability of the EMU balance

The costs for the State involved with the issuance of inflation linked bonds bear a positive relation to the rate of inflation: rising inflation by definition means higher costs, while falling inflation means a lower interest burden. More specifically: if in any year the rate of inflation increases by 1% point, the costs of inflation linked bonds will increase by 1% of the value of the outstanding inflation linked bonds. Whether inflation linked bonds limit the effect of an inflation shock on the EMU balance depends on the relationship between this balance and the rate of inflation. The introduction of inflation linked bonds will counteract the effect of an inflation shock on the EMU balance if this balance improves when inflation rises and worsens when inflation falls.

The CPB has examined the effect of inflation on the EMU balance both by using the SAFE model and via regression analysis. Its findings are described below. For a more detailed explanation, reference is made to the original CPB paper. This paper is available in Dutch only and can be found on the CPB website.[3] Both analyses suggest a positive relationship between the EMU balance and the rate of inflation.

Practice", *Treasury Occasional Paper No: 10: Debt Management,* p.2, and by Jakob de Haan and Guido Wolswijk (2005), "Government Debt Management in the Euro Area", ECB Occasional Papers Series no. 25, pp. 4-8.

[3] CPB Memorandum 139: 'De betekenis van inflatiegeïndexeerde leningen voor het Nederlandse EMU-saldo' (CPB, February 2006, to be found at www.cpb.nl). Apart from the relationship between the nominal EMU balance and the rate of inflation, this paper also addresses the relationship between the real EMU balance and the rate of inflation. The real EMU balance is defined as the nominal EMU balance adjusted for the depletion of debt owing to inflation: real EMU balance (as a %) = nominal EMU balance (as a %) + [debt ratio x rate of inflation (as a %)].

With the aid of the SAFE model, the consequences have been identified of seven different inflation and demand shocks that lead to higher inflation. The inflation shocks used are: a rise in wages, a fall in the euro exchange rate, a rise in oil prices and an increase in indirect taxes. The demand shocks are: an increase in the volume of world trade, higher private consumption and higher government spending. In each of these scenarios, it is possible to determine the extent of the shock required in order to realise a 1-percentage-point rise in inflation during the first year and subsequently keep prices at the higher level during the next three years. Such a shock also causes the EMU balance to change.[4]

The analysis shows that shocks that increase inflation by 1% point from the first year will improve the EMU balance by an average of 0.18% of GDP per year when compared to the baseline.[5] The effect on the EMU balance differs from one variant to another. For example, the effect is no less than +4% of GDP in case of an increase in private consumption and –5% of GDP in case of higher government spending (table 3.1). It also appears that the improvement of the EMU balance is particularly strong in the year of the shock. The effect in year 1 is 0.34% of the GDP on average and is caused mainly by the fact that the tax revenue responds more strongly to the shock than the non-interest expenditure. The drop in interest costs resulting from a shock that pushes up inflation is partly attributable to a denominator effect, and is partly related to the fact that the interest costs also depend on the size of the deficit. The results in the table show that if the price is maintained at the higher level, the effect on the EMU balance slightly diminishes over the years.

[4] The change in the balance is the result of the original shock, and need not necessarily be caused by the change in the rate of inflation that occurs as well.

[5] This is the unweighted average calculated over the first three years and all seven shocks. For reasons of policy relevance, the CPB disregards the VAT variant and the variant in which government spending increases. The average improvement of the EMU balance exclusive of these variants is 0.28% of the GDP.

Table 3.1. Effect of an inflation shock on the EMU balance, simulated with inflation and demand variants in SAFE

	Inflation variants											
Change (cumulative) [a]	**Wages (+)**			**Euro rate (-)**			**Oil prices (+)**			**VAT (+)**		
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
CPI [b]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GDP volume	0.03	-0.07	-0.17	0.88	0.51	0.40	-1.28	-0.78	-0.74	-0.19	-0.29	-0.36
Non-interest expenses (% of GDP)	0.55	0.46	0.53	-0.42	-0.33	-0.26	-0.06	-0.28	-0.19	-0.04	0.05	0.08
Interest (% of GDP)	-0.07	-0.07	-0.07	-0.04	-0.04	-0.04	0.11	0.04	0.05	-0.03	-0.05	-0.06
Taxes (% of GDP)	0.90	0.54	0.40	-0.08	0.01	0.07	0.06	-0.20	-0.32	0.50	0.42	0.35
EMU balance (cumulative, % of GDP)	0.41	0.15	-0.07	0.38	0.39	0.38	0.00	0.02	-0.18	0.57	0.41	0.33
EMU balance (annual change, % of GDP)	0.41	-0.27	-0.22	0.38	0.00	0.00	0.00	0.02	-0.20	0.57	-0.16	-0.08
	Demand variants											
Change (cumulative) [a]	**World trade (+)**			**Private consumption (+)**			**Govt. spending (+)**					
	Year 1	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**			
CPI [b]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
GDP volume	5.33	3.20	2.00	7.50	4.00	2.25	6.69	3.23	1.82			
Non-interest expenses (% of GDP)	-2.50	-1.80	-1.00	-3.50	-2.00	-1.00	4.85	2.15	1.43			
Interest (% of GDP)	-0.17	-0.20	-0.19	-0.25	-0.33	-0.38	-0.23	-0.04	0.00			
Taxes (% of GDP)	-0.67	0.20	0.50	0.50	1.00	1.00	-0.46	0.46	0.57	**Avg improvement in**		
EMU balance (cumulative, % of GDP)	2.00	2.20	1.69	4.00	3.33	2.38	-5.00	-1.65	-0.84	**balance in first 3 years:**		
EMU balance (annual change, % of GDP)	2.00	0.20	-0.51	4.00	-0.67	-0.96	-5.00	3.35	0.81			**0.18**

a The baseline is in levels. This concerns changes in relation to the baseline. When viewed from year to year, therefore, the change (in % points for the price and in % of GDP for the effect on the balance) is cumulative.
b Inflation in SAFE is endogenous. Generating an inflation shock of 1% point in year 1 often requires a severe shock. For example, in the first year a wage shock of 3.5% is required, a world trade shock of nearly 17% and a shock in private consumption of 25%. To keep prices at the higher level in years 2 and 3, the shocks have to be adjusted.

The relationship between the EMU balance (as a % of GDP) and the Dutch CPI inflation has also been examined with the aid of regression analysis.[6] The equation is as follows:

$$\text{EMU balance}_t = \alpha + \beta\ (P_t - P_{t-1}) / P_{t-1} + \mu_t$$

Again, a positive relationship was found as regards the period 1970-2003. On average, the EMU balance improves by 0.22% of GDP for each 1% point of inflation. The result of the regression

[6] The rate of inflation ($(P_t - P_{t-1}) / P_{t-1}$) is based on the derived CPI, so that changes in indirect taxes do not affect inflation.

analysis is not particularly stable and changes if estimation is performed for different sample periods.[7]

Table 3.2. Outcome of OLS regression with EMU balance as the dependent variable and the rate of inflation as the independent variable (1970-2003)

EMU balance =	α	$+ \beta$	* CPI inflation	R^2
	-3.52	0.22		0.08

The above analyses of the effect of inflation on the EMU balance suggest that, on average, the EMU balance improves when inflation rises. The effect found is roughly 0.2% of GDP for each percentage point of inflation. Based on past experience, therefore, it may be expected that on average the issuance of inflation linked bonds will somewhat increase the stability of the EMU balance. Given the size of the effect, an outstanding volume in inflation linked bonds of 20% of GDP (about half of the national debt[8]) will be required in order to completely neutralise the effect of inflation on the budget.

Box 3.2. Causes of a positive relationship between budget and inflation

The positive relationship between budget and inflation has various causes. For instance, government revenue is quicker to respond to an inflation shock than expenditure. If there is an extra price increase, government revenue will fairly quickly increase accordingly. However, this does not apply to government spending. It is reasonable to assume, for instance, that there will be some delay before an inflation shock has been incorporated in civil servants' salaries and social security benefits. As a result, there is an average improvement of the EMU balance especially in the year of the shock.

Furthermore, a numerator effect and a denominator effect can be perceived with regard to the interest costs as a percentage of GDP.
The first factor for the *effect of inflation on the numerator* is the extent to which inflation affects the interest rate. Subsequently, the size of the deficit plus the part of the debt that has to be refinanced each year determine the degree to which this interest rate influences the interest costs. The smaller the deficit and the refinancing (i.e., the longer the term to maturity of the portfolio), the smaller the effect of inflation on the numerator. The decisive factor for *the denominator effect* is nominal growth. A high rate of inflation and strong volume growth both cause a considerable denominator effect. R*elative to* the numerator, the effect on the denominator will be greater if strong nominal growth is caused primarily by strong volume growth (rather than inflation).

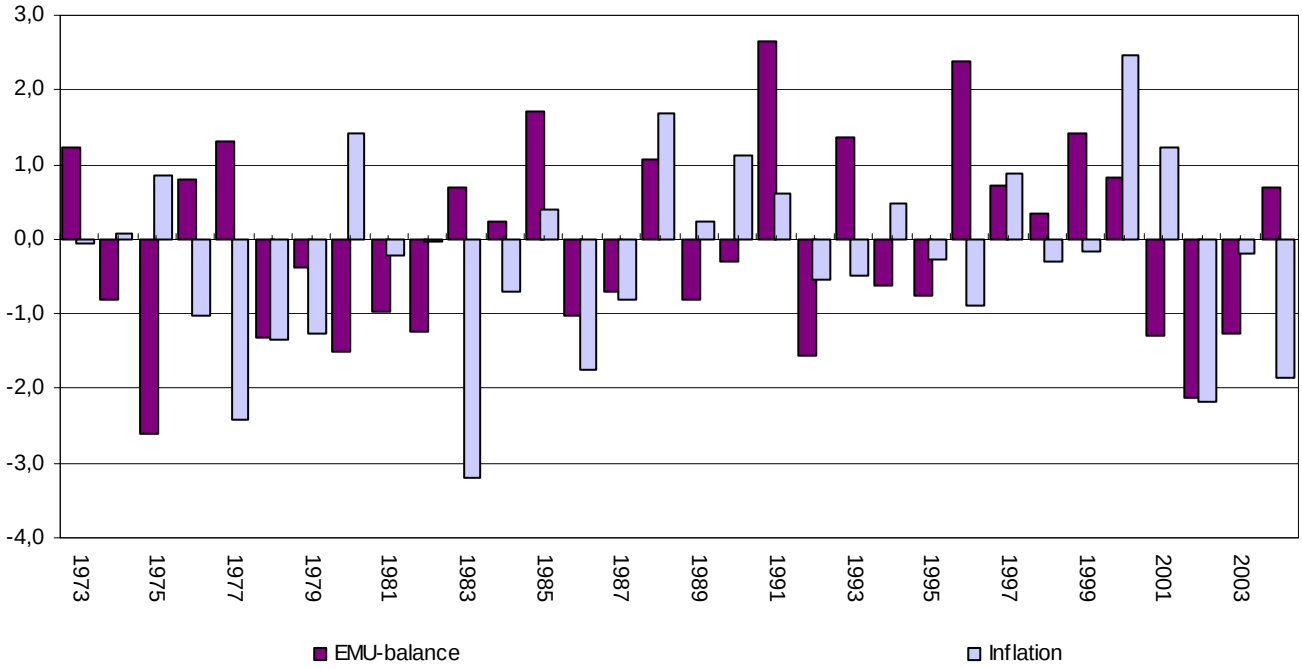
During the 1970s, the average nominal growth rate was high and the deficit small, so that the denominator effect was predominant. In the period 2000-2005, on the other hand, the average EMU deficit was high, as was the annual refinancing. The numerator effect was predominant during this period, especially in 2003 (high deficit, considerable inflation and negative volume growth).

[7] The result for part-periods is not significant either. Furthermore, it should be borne in mind that policy changes (such as changes to the tax system) may affect the relationship between the CPI rate of inflation and the budget.

The fact that the stabilisation of the EMU balance with the aid of inflation linked bonds is an average effect means that the issuance of inflation linked bonds in any particular year may have either particularly favourable or particularly unfavourable consequences. For this reason, absolute variability in the interest costs is essential. This implies that there is a limit to the share of inflation linked bonds in the debt portfolio.

If inflation and EMU balance move in the same direction, inflation linked bonds will stabilise the balance and the issuance of inflation linked bonds will be attractive on that account. This will not be the case if the two quantities move in opposite directions. In 2002, for instance, inflation and EMU balance moved in the same direction. The EMU balance deteriorated by 2.1 percentage points, while inflation fell by 2.2 percentage points. If 20% of GDP had been outstanding in inflation linked bonds, the deterioration in the balance would have been 0.44% GDP smaller. In 2001, inflation and EMU balance moved in opposite directions; the EMU balance deteriorated by 1.3 percentage points in that year. In the same year, inflation rose by 1.2 percentage points. If 20% of GDP had been outstanding in inflation linked bonds at that time, the EMU balance, ceteris paribus, would have deteriorated an extra 0.24% of GDP.

Figure 3.1 Year-on-year change in EMU balance and inflation, 1973-2004



[8] The national debt is not the same as the EMU debt. Firstly, the national debt refers only to the central government debt. Furthermore, a number of changes are made to the national debt in order to arrive at the ESA definition of the EMU debt.

3.2. Nominal bonds and stability of the EMU balance

The stabilising effect of inflation linked bonds on the EMU balance is caused by the fact that when inflation linked bonds are issued, the interest costs will follow the rate of inflation more expressly. However, the interest costs will also respond to inflation *without* the issuance of inflation linked bonds.

Part of the debt is refinanced each year. In addition, the budget deficit needs to be funded as well. Insofar as a change in the rate of inflation affects the interest rate payable on the refinancing and the deficit, inflation will affect the interest costs. To what extent a change in the rate of inflation affects the interest costs depends on three factors: i) the extent to which the shock affects the interest rate[9], ii) the size of the annual refinancing and iii) the size of the deficit.

A reduction of the average term to maturity of the portfolio implies that a larger part of the debt needs to be refinanced each year. As an inflation shock may be expected to affect short-term interest rates, a reduction of the term to maturity of the debt portfolio (if effectuated over a longer period of time) will also, on average, stabilise the EMU balance to a certain degree.[10]

3.3. Interest costs and real expenditure framework with and without inflation linked bonds

It is sometimes argued that the interest costs associated with the issue of inflation linked bonds would fit the real expenditure framework that is used in Dutch budgetary policy better than the issue of nominal bonds.

The real expenditure framework is a policy tool that covers almost all State spending. At the start of each government term and for the duration of the term, a specific path is set out along which spending (as part of the framework) is allowed to grow in real terms. Predetermination of expenditure growth in real terms implies that the expenditure framework has to be adjusted each year for the rate of inflation. If inflation were to rise by 1 percentage point, the framework would increase in size by roughly 1%.[11] In nominal terms, each spending item within the framework is thus allowed to grow by 1%. Relative to GDP, spending will not change.

The interest costs are part of the real expenditure framework. These costs are subject to change owing to the funding of the budget balance and to changes in the interest rate (because part of the debt is refunded each year). The argument that the interest costs associated with the issue of inflation linked bonds nicely fit the real expenditure framework because inflation linked bonds are

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The EMU debt was 56% of the GDP in 2004, while the national debt was 46% of the GDP in that year.

[9] Whether and to what extent the interest rate responds to an inflation shock will depend on the nature of the shock; for example, whether it occurs at national level or EU wide, and whether it is temporary or permanent.

[10] An indication of the extent to which inflation shocks affect short-term interest rates can be obtained by looking at the correlation between the year-by-year change in the rate of inflation and the call rate. Depending on the period, this ranges between 0.54 and 0.84. This suggests that inflation shocks affect short-term interest rates.

also denominated in real terms, confuses the inflation-sensitivity of the stock of debt with the inflation-sensitivity of the flow variable; the interest costs.
When funded entirely through inflation linked bonds, not only the flow of coupons but the entire stock of debt is inflation-sensitive. That the stock of debt responds one-to-one to changes in the inflation rate does not imply the same inflation-sensitivity for the flow variable; the interest costs in the budget. As the interest costs are much smaller than the stock of debt, an increase in the costs of 1% over the stock of debt implies a much larger percentage increase in the interest costs. As long as only nominal bonds are used, the inflation-sensitivity of the stock is limited to the share of debt that is refunded each year (and only to the extent that inflation feeds through to the interest rate). Even in this case, the interest costs would increase by substantially more than 1% if inflation rose by 1 percentage point, given that the share of debt that is refinanced each year is generally much larger than the interest costs. For simplicity assume that 20% of the debt (50 billion euros) is refunded each year and that changes in inflation completely feed through to the interest rate. Then, a 1 percentage point rise in inflation would raise interest costs by 0,5 billion euros. This amounts to a 4% increase in this expenditure item, which is substantially more than the 1% room that would be available under the inflation-adjusted expenditure framework. The use of inflation linked bonds would amplify the response of interest costs to inflation, leading to an even larger discrepancy between the adjustment of the framework and the rise in interest costs.

Considering how the funding policy is designed and taking into account the fact that fluctuations in the interest costs are predominantly driven by developments in the budget balance, it is not plausible per se to restrict changes in the interest costs to the limits implied by the real expenditure framework. However, from the point of view of fitting the expenditure framework, there is no valid argument for issuing inflation linked bonds.

3.4. Summary and conclusions

Inflation linked bonds and inflation

If the national debt is issued primarily in the form of long-term nominal bonds, the reaction of the interest costs to inflation will be limited. This reaction will intensify as a larger part of the debt is refinanced each year. If inflation linked bonds are issued, the interest costs will respond much more emphatically to inflation because the entire debt financed through inflation linked bonds will be affected by changes in the rate of inflation. The effect of inflation on the interest costs will depend on the size of the indexed debt.[12] If an inflation linked bond of 20% of GDP is

[11] The price deflator for national income is used to periodically adjust the real expenditure framework for inflation. Although there is a strong correlation between the price index of national income and the CPI, it is not perfect.

[12] If a 10-year nominal loan of € 10 billion is issued every year, € 100 billion will be outstanding after 10 years. As an inflation shock only affects refinancing (newly-issued debt) in the case of nominal loans, an inflation shock of 1% point (if this fully affects the interest rate) will result in a maximum of € 100 million (€ 10 billion * 1%) in additional interest costs. If the whole debt is financed with short-term instruments (treasury notes), the whole debt of € 100 billion should be refinanced every year. If the same is assumed with regard to the interest, an inflation shock of 1% point will then result in € 1 billion (€ 100 billion * 1%) in additional interest costs. If a 10-year index loan of € 10 billion is issued every year, the amount outstanding after 10 years will again be € 100 billion. As the principal amount is indexed in the case of inflation linked bonds, an inflation shock of 1% point will immediately result in € 1 billion (€ 100 billion * 1%) in additional interest costs.

outstanding, a 1-percentage-point rise in inflation will, on average, generate 0.2% of GDP in additional interest costs.

Budget (excluding inflation linked bonds) and inflation

The CPB has examined the effect of inflation on the EMU balance both by using the SAFE model and via regression analysis. Both analyses suggest a positive relationship between the EMU balance and the rate of inflation. On average, the EMU balance improves by 0.2% of GDP for every percentage point of inflation. The effect found has various causes. On the one hand, government revenue is quicker to respond to an (inflation) shock than expenditure. As a result, the balance improves especially in the year of the shock. In subsequent years, the effect partly fades away. On the other hand, there is a denominator effect as regards the interest costs (as a % of GDP), because the issuance of long-term bonds restricts the response of the numerator to inflation.

Inflation linked bonds as a hedge

Considering that the EMU balance improves on average as inflation rises, and inflation linked bonds become more expensive as inflation increases, inflation linked bonds constitute a hedge against the inflation risk in the budget. It should be stressed that this concerns an average effect. The relationship between balance and inflation differs in proportion to the nature of the shock. This means that the issuance of inflation linked bonds in any year may have extremely favourable or extremely unfavourable consequences. There is by no means a perfect hedge (stabilisation in both the short and the long term). When viewed in this way, absolute variability in the interest costs is an essential factor. This variability limits the share of inflation linked bonds in the debt portfolio.

Restriction of term to maturity also classifies as a hedge

The interest costs may also respond to inflation without the presence of inflation linked bonds. A part of the debt should be refinanced each year. The budget deficit needs to be funded as well. Insofar as a change in the rate of inflation affects the interest rate payable on refinancing and deficit, inflation will influence the interest costs. To what extent this is the case will depend on the extent to which the shock affects the interest rate, the size of the refinancing and the size of the deficit. A reduction of the average term to maturity of the portfolio will increase the portion to be refinanced annually. Because an inflation shock may be expected to affect the (short-term) interest rates, a reduction of the term to maturity of the debt portfolio (if this is effectuated over a longer period of time) will also, on average, stabilise the EMU balance to a certain degree.

Inflation linked bonds do not fit the expenditure framework

The interest costs associated with the issue of inflation linked bonds are not a good fit to the real expenditure framework. It is sometimes argued that, as long as only nominal funding is applied, the interest costs will move less than one-on-one with inflation. Since the interest costs are part of the real expenditure framework, it would be preferable that (like the framework) they move in line

with inflation. Although nominal funding limits the inflation-sensitivity of the stock of debt, it is by no means true that the interest costs would move less than one-on-one with inflation. A 1 percentage point increase in the inflation rate to be paid over the share of debt to be refunded, will imply a disproportionate increase -- in percentage terms -- in the interest costs in the budget. The issue of inflation linked bonds would further raise the sensitivity of the interest costs to inflation leading to an even larger discrepancy between adjustment of the framework and the rise in interest costs.

4. Business case: do inflation linked bonds offer a better risk/cost ratio than nominal bonds?

The main objective of the funding strategy has been defined as *the borrowing of funds, in order to refinance the current debt and finance the deficit at the lowest possible cost within an acceptable degree of risk as regards the fluctuations in the budgeted interest costs*. Essentially this means that those combinations of debt instruments should be applied that result in the most favourable ratio between interest costs and risk. Risk has been defined as the fluctuation in the interest costs on Budget IXA. This is also known as an efficient strategy. An efficient financing strategy is an issuance strategy that results in the lowest interest costs at a given variability, or the lowest variability – i.e. the greatest predictability of the nominal interest costs – at a given level of the interest costs. Within the present funding policy, there will be a business case for inflation linked bonds if these offer an equal or better cost/risk ratio than the nominal instruments currently used by the State (treasury notes, government bonds).

Box 4.1 Assumptions underlying the funding policy

Key features of the funding policy at a national and international level

The mandate for most debt managers both within and outside Europe (OECD) is to finance the national debt as efficiently as possible under an acceptable risk to the budget. The manner in which efficient financing is given shape develops over time. A recurring point in this context is the question to what extent new approaches can improve efficiency.

In recent years, for example, the concept of 'asset and liability management' (ALM) has received a lot of attention. In an ALM approach, companies take the financial characteristics of their assets into account in the make-up of their liabilities (equity capital and loan capital). In this way, undesirable fluctuations in future cash flows may be (partly) avoided. The idea behind an ALM approach for the government is that temporary shocks lead to uncertainty, for instance in respect of taxation or wealth, which means that private individuals and businesses take less efficient decisions. By absorbing temporary shocks (via the interest costs), the government maximises prosperity. Research into the ALM concept applied by the government focuses on three approaches. These approaches look at the debt portfolio as a hedge (i) for the economy as a whole, (ii) for the government balance sheet or budget (tax smoothing), or (iii) only for those tangible and intangible assets that generate cash flows. Although all three approaches yield valuable insights, their practical application appears to be impossible (as yet), not least because of information problems.[13] Without detracting from the possible value of the ALM concept for the government, the IMF and the World Bank therefore recommend the following (for the time being): "The main objective of Debt Management should be to ensure that government's funding needs and its payment obligations are met at the lowest possible cost over the medium term, consistent with a prudent degree of risk." [14]

In accordance with the IMF and World Bank guidelines and with what is common practice internationally, the Dutch State has as its main objective: *'The borrowing of funds, in order to refinance the current national debt*

[13] New Zealand Debt Management Office, (2002), *Sovereign Asset-Liability Management in New Zealand*

[14] International Monetary Fund and World Bank, (2001), *Guidelines for Public Debt Management* (Washington, D.C.). International Monetary Fund and The World Bank, (2002), *Guidelines for Public Debt Management Accompanying Document* (Washington, D.C.).

and finance the deficit at the lowest possible cost within an acceptable risk as regards the fluctuations in the budgeted interest costs.' Key feature of the funding policy is therefore the weighing up of the cost and risk of the financing instruments, whereby risk is defined as the fluctuation in the interest costs on Budget IXA.

The funding policy is reassessed and redesigned every four years (the current policy covers the period 2003-2006). To this end, a number of scenarios are worked out in respect of the acceptable risk. In drafting these scenarios, macroeconomic insights are implicitly taken into account, as are the lessons derived from ALM-like approaches. For example, the risk partly determines the extent of short-term financing. In this way, it establishes the maximum contribution of debt management to deficit stabilisation over the economic cycle.

Implementation of the funding policy

The following applies where the implementation of the funding policy is concerned. Principal assumption is that the yield curve slopes upward in the long term. Furthermore, the State financing occurs gradually over time in order to avoid 'point risks'. For the same reason, the issuance strategy is spread over bonds with various maturities, although the number is restricted. The assumption of an upwardly sloping yield curve offers guidance when selecting the term to maturity of the portfolio. As long as the risk to the budget is acceptable, short-term financing is applied because this is cheaper on average. Only when the 'quota' in terms of risk is full will funds be borrowed in the longer term at greater expense. Precondition as regards the risk is that this should remain constant in terms of GDP. After all, its proportion to GDP determines the extent to which the risk actually encumbers the economy. In absolute terms, the amount-at-risk should grow in line with GDP. On the one hand, this means that if there is a growth in GDP but the debt remains constant in absolute terms, a relatively larger part of the debt portfolio can be financed with short-term bonds. On the other hand, a constant debt ratio (as a percentage of GDP) will have the effect that the ratio between long-term and short-term bonds in the debt portfolio remains unchanged as well.

The level at which the risk is kept constant (as a percentage of GDP) has been set at 9%. This means that the part of the debt which is refinanced each year, and which is therefore exposed to interest rate changes, should amount to 9% of GDP. Control is limited to the refinancing of the current debt (new deficits are disregarded). This is therefore known as the basis risk.[15] The choice in favour of 9% was based on the following considerations. On the one hand, the State's money market portfolio should be large enough to absorb unexpected fluctuations in funding need. If the basis risk were smaller than 9% of GDP, the money market portfolio would soon reach a critical level and the liquidity of this instrument would be jeopardised. On the other hand, a basis risk exceeding 9% of GDP would imply that issuance differed greatly from that of previous years. In addition, the Netherlands would in this case take greater risk in that situation than, say, France, which may harm the reputation of a stable policy.

First of all, Section 4.1 will address the theoretical size of the inflation risk premium which the State (taking over the inflation risk) would save by issuing inflation linked bonds. Sections 4.2 and 4.3 will set out (ex ante and ex post respectively) the savings of inflation linked bonds in comparison with nominal bonds with an identical term. There are various causes as to why the savings realised fall short of the savings forecast in theory. These causes will be discussed in

[15] Control of the basis risk is effectuated by distinguishing term buckets. Because of decisions made in the past, the current debt consists of bonds with a remaining term ranging from 1 to 30 years. The first bucket contains all the instruments that have to be refinanced within a year and are therefore sensitive to interest changes. This bucket comprises the basis risk. The second bucket contains the debt paper that matures in 1 to 2 years' time and should then be refinanced, etc.

Section 4.4. Section 4.5 will use the earlier-found savings of inflation linked bonds in relation to nominal bonds in order to compare the ratio between the variability and size of the interest costs of inflation linked bonds and nominal bonds respectively.

4.1. Theoretical size of the inflation risk premium

Inflation linked bonds may be attractive in comparison with other instruments, because the State, although taking over the inflation risk from the investor in respect of inflation linked bonds, may expect to receive the so-called inflation risk premium in return. This works as follows. An investor in nominal debt instruments runs the risk that inflation turns out to be higher than was expected and incorporated in the nominal interest rate. The investor will demand compensation for this risk. The issuance of inflation linked bonds will eliminate the inflation uncertainty, thereby removing the need for compensation. If the transfer of the inflation risk were the only difference between nominal bonds and inflation linked bonds, the State would on balance save the inflation risk premium. In practice, however, nominal and inflation linked bonds are not fully comparable. Whether the issuance of inflation linked bonds yields a net benefit will therefore also depend on other factors – in addition to the size of the inflation risk premium – that affect the price, such as liquidity and supply and demand.[16]

There are many theories about the size of the inflation risk premium. Campbell and Schiller[17], using bond interests and the average difference between short-term and long-term interest over the period 1954-1994 for the dollar market, calculate a theoretical premium of 70-100 basis points for a 5-year bond. Furthermore, they calculate the diversification benefits of adding inflation linked bonds to a share portfolio and to mixed portfolios of shares and bonds. This results in an inflation risk premium of 60 to 150 basis points. The researchers conclude that, by and large, nominal bonds with a 5-year term to maturity carry an inflation risk premium ranging between 50 and 100 basis points. This line of reasoning implies identical or larger benefits for longer-term bonds. An inflation risk premium of 50-100 basis points would more than outweigh the disadvantages of inflation linked bonds, such as reduced liquidity. On balance, therefore, the benefit for the State would be substantial.

4.2. Expected saving in comparison with long-term nominal bonds

Ever since inflation linked bonds were first issued, the *expected (ex-ante) benefit* of inflation linked bonds can be calculated at the time of issue. The difference between the nominal and the real interest is the so-called break-even inflation. The break-even inflation equals expected inflation *plus* a compensation for the inflation risk, the liquidity differences, differences in supply and demand ratios, etc. Setting off the inflation forecast obtained through surveys against the

[16] See, for example, Francis Laatsch and Daniel Klein, (2003), Nominal rates, real rates, and expected inflation: results from a study of US Treasury Inflation-Protected Securities, the Quarterly Review of Economics and Finance 43, pp. 405-417.

break-even inflation will leave a residual term. If an efficient market is assumed, the inflation forecast will on average be correct (unbiased), which means that the government would, on average, save the residual term by issuing inflation linked bonds.

Calculations based on surveys by Consensus Economics show that the residual term may be either positive or negative in practice (table 4.1). Furthermore, calculations show that for the US there was (at the time of issuance) an extra cost on average for the State of 40 basis points. A limited number of observations for France reveal that here, too, there initially was an expected additional cost. In recent years there has been an expected benefit. It seems that the market is pricing French inflation linked bonds increasingly efficiently. The average benefit over all observations is 20 basis points. Over the last three years, the average benefit is 43 basis points. In the UK there is an expected benefit for the State as well. On average, this benefit is 35 basis points over all observations and 46 basis points over the last three years. The benefit is slightly higher than in France. This may be attributable to the differences in supply/demand ratios between the UK and other countries. In the UK, the high-powered pension funds with real commitments might be prepared to pay a premium towards the issuance of inflation linked bonds. A great demand for inflation linked bonds may therefore have the result that the total sum of factors determining the distinction between nominal bonds and inflation linked bonds has a favourable net effect for the State.

[17] Campbell and Schiller, (1996), A Scorecard for indexed government debt, Cowless Foundation discussion papers.

Table 4.1. Consensus forecast of inflation compared with break-even inflation[18]

	a	b	c	d	e
US	10-year inflation forecast	Nom. interest	Real interest	Break-even inflation (b-c)	Difference (d-a)
10 May '99	2.5	5.53	3.86	1.67	-0.83
8 May '00	2.6	6.56	4.15	2.41	-0.19
14 May '01	2.6	5.44	3.24	2.2	-0.4
10 Dec '01	2.8	5.1	3.6	1.5	-1.3
13 May '02	2.4	5.22	3.12	2.1	-0.3
11 Nov '02	2.5	3.84	2.33	1.51	-0.99
10 Nov '03	2.2	4.48	2.05	2.43	0.23
10 May '04	2.2	-4.79	2.24	2.55	0.35
9 May '05	2.8	-4.28	1.67	2.61	-0.19
				Average	-0.40
				Idem, last 3 years	0.13
France	10-year inflation forecast	Nom. interest	Real interest	Break-even inflation (b-c)	Difference (d-a)
10 May '99	1.5	4.13	2.74	1.39	-0.11
11 Nov '02	1.7	4.52	2.77	1.75	0.05
10 Nov '03	1.8	4.49	2.24	2.25	0.45
9 May '05	1.7	3.46	1.35	2.11	0.41
				Average	0.20
				Idem, last 3 years	0.43
UK	10-year inflation forecast	Nom. interest	Real interest	Break-even inflation (b-c)	Difference (d-a)
10 May '99	2.4	4.89	1.94	2.95	0.55
8 May '00	2.3	5.34	2.12	3.22	0.92
14 May '01	2.4	5.08	2.58	2.50	0.1
10 Dec '01	2.6	4.93	2.48	2.45	-0.15
13 May '02	2.3	5.27	2.46	2.81	0.51
11 Nov '02	2.2	4.52	2.34	2.18	-0.02
10 Nov '03	2.5	5.05	2.21	2.84	0.34
9 May '05	2.2	4.55	1.77	2.78	0.58
				Average	0.35
				Idem, last 3 years	0.46

4.3. Realised savings versus nominal long-term bonds

Now that a number of countries have issued inflation linked bonds over a number of years, (ex-post) experience data about the *savings realised through the issuance of inflation linked bonds* is also available. Calculations are available for the UK as regards the period up to 1999. The

[18] The calculations are restricted to the data included in the ten-year inflation forecasts published by Consensus Economics. Subsequently the ten-year interest rate for both nominal loans and inflation linked bonds from the secondary capital market is applied in respect of this data.

Swedish Debt Management Office, the US Treasury and the French Agency have not published any calculations as of yet, but an estimate of the relative costs is often available or possible.[19]

Experiences in the UK and Swedish markets

Experiences in the UK show that, during the period 1981-1999, the issuance of inflation linked bonds resulted in significant savings. A major benefit was realised in the 1980s, when the market underestimated the commitment and the options on the part of the authorities to reduce the high rate of inflation. Since 1999, the outcome varies. From one year to the next, inflation linked bonds either cost or saved the State money, with a positive balance of 2.5 billion euros in 2005. Table 4.2 shows the result in basis points and millions of euros per year.

Table 4.2. Realised result UKTI2032 (issuances from 2000)

Issuance date	Issuance bn € (a)	Break-even inflation/year (c)	Inflation/year (c)	Result (b-c) basis points/year	m €/year
26-10-2000	0.450	2.80%	2.33%	0.47%	9.60
25-1-2002	0.500	2.49%	2.93%	-0.43%	-7.03
1-3-2002	0.014	2.54%	3.04%	-0.50%	-0.22
6-6-2002	0.057	2.86%	2.83%	0.03%	0.05
29-9-2004	0.350	2.94%	2.87%	0.08%	0.16
2-3-2005	0.400	2.98%	3.03%	-0.04%	-0.03
Position as at 29-4-2005	**1.771**			**-0.07%**	**2.54**

Experiences in Sweden confirm those in the UK. Sweden indicates that the issuance of inflation linked bonds at times of high/increasing inflation causes investors to expect (too) high future inflation rates. If the authorities subsequently manage to reduce these rates, inflation linked bonds will yield a benefit. As soon as inflation rates move towards the target value and are perceived to be under control, new issuance of inflation linked bonds will yield a reduced benefit or even an additional cost.

Experiences in the US

A number of publications are available where the USD market is concerned. The first (2002) shows that until 2001 the US Treasury paid, rather than received, premiums (around $1 billion).[20] The second publication (2003)[21] confirms the outcome of the first. The most recent publication

[19] In an OECD study ("Survey results on the Cost-effectiveness of Inflation-Linked Bonds", 2003), France indicates that inflation linked bonds are attractive to investors because they offer them a higher interest rate. The French State reports that it cannot comment on the costs until the first index loan has matured: in 2009.

[20] Brian Sack and Robert Elsasser: Treasury Inflation-Indexed Debt: a review of the US experience, Federal Reserve Bank of New York, 2002.

[21] Francis Laatsch and Daniel Klein: Nominal rates, real rates, and expected inflation: results from a study of US Treasury Inflation-Protected Securities, Quarterly Review of Economics and Finance 43 (2003) 405-417. Although the approach of the publication is not a cost calculation from the US Treasury's point of view, its conclusions are nevertheless relevant. It focuses on the question which discount factors investors should use in 'pricing' TIPS inflation linked bonds, rather than on the cost for the US Treasury. The publication concludes that the Fisher hypothesis (forecast inflation has a one-to-one effect on the nominal interest rate) cannot be rejected. Non-rejection of the hypothesis means that an investor will receive extra compensation for inflation if the latter increases. This corresponds to the assumption, customary in the financial markets, that the nominal interest offers inflation compensation, and that, certainly where investors build up their portfolio by constant 'sampling' (spreading out investment moments evenly through time where possible), changes in inflation also result in comparable compensation. The authors conclude that the actual inflation was always higher than the inflation allowed for, and that consequently investors always received higher coupon payments than had been forecast. Conversely, therefore, the Treasury sustained a disadvantage.

(2004)[22] indicates that until 2003 the Treasury paid around $3 billion more by issuing inflation linked bonds rather than nominal bonds. The currently outstanding volume (around 150 billion issued) is expected to cost the Treasury $12 billion extra until the end of their term.[23] This corresponds to a cost increase of 0.5 percent (50 basis points) per year.

Experiences in France

As regards the euro market, no publications comparable with the USD market are available. France is the only country in the euro area with a slightly longer history with respect to inflation linked bonds. According to its own calculations (table 4.3) regarding the OATi 2009 (with an outstanding amount of around 13 billion), the French State has paid around 200 million in extra interest costs up to now. The more recent 2012ei (European inflation) has cost the French state around 90 million extra up to now (table 4.3, second half). This bond, however, has only been around since the end of 2001.

Table 4.3. Realised result of the French OATi-2009 and OAT2012ei

OATi-2009	**Issuance**	**Break-even**	**Inflation/year (c)**	**Result (b-c)**	
Issuance date	**bn € (a)**	**inflation/year (b)**		**basis points/year**	**m** €/year
5-11-1998	4.47	1.18%	1.54%	-0.36%	-99.42
4-2-1999	0.63	0.89%	1.62%	-0.73%	-26.83
1-4-1999	0.68	1.10%	1.72%	-0.62%	-24.08
6-5-1999	0.55	1.37%	1.69%	-0.32%	-9.83
1-7-1999	0.58	1.77%	1.62%	0.15%	4.85
3-2-2000	0.55	1.69%	1.79%	-0.10%	-2.66
4-5-2000	0.26	1.94%	1.77%	0.17%	2.02
6-7-2000	0.37	1.70%	1.73%	-0.03%	-0.58
5-10-2000	0.55	1.66%	1.77%	-0.11%	-2.52
18-1-2001	0.5	1.45%	1.73%	-0.28%	-5.44
5-4-2001	0.48	1.40%	1.93%	-0.53%	-9.38
21-6-2001	0.41	1.59%	1.76%	-0.17%	-2.45
10-1-2002	0.29	1.28%	1.80%	-0.52%	-4.48
21-3-2002	0.59	1.69%	1.90%	-0.21%	-3.42
2-5-2002	0.62	1.75%	1.86%	-0.11%	-1.90
20-6-2002	0.18	1.58%	1.72%	-0.14%	-0.63
9-1-2003	1.31	1.36%	1.75%	-0.39%	-9.99
19-6-2003	0.38	1.36%	1.48%	-0.12%	-0.72
3-7-2003	0.2	1.49%	1.56%	-0.07%	-0.20
6-11-2003	1.07	2.06%	1.80%	0.26%	3.26
Position as at 31-12-2004	**14.67**			**-0.21%**	**-194.41**

[22] Brian Sack and Robert Elsasser: Treasury inflation indexed debt: a review of the US experience, Federal Reserve Bank of New York Economic Policy Review, May 2004, pp. 47-63.
[23] Idem, p. 57.

Table 4.3. (continued) Realised result of the French OATi-2009 and OAT2012ei

OAT2012ei	Issuance	Break-even	Inflation/year (c)	Result (b-c)	
Issuance date	bn € (a)	inflation/year (b)		basis points/year	m €/year
9-12-2001	6.50	1.43%	1.84%	-0.41%	-82.2
10-1-2002	0.70	1.67%	1.93%	-0.26%	-5.4
21-3-2002	0.70	2.00%	1.98%	0.02%	0.4
2-5-2002	0.60	2.13%	1.94%	0.19%	3.1
20-6-2002	0.60	1.98%	1.71%	0.27%	4.0
9-1-2003	0.30	1.84%	1.85%	-0.01%	-0.1
15-5-2003	0.20	1.70%	1.88%	-0.18%	-0.6
3-7-2003	0.60	1.75%	1.77%	-0.02%	-0.2
19-2-2004	0.60	2.06%	2.29%	-0.23%	-1.2
15-4-2004	1.10	2.16%	2.94%	-0.78%	-6.1
25-5-2004	0.70	2.27%	2.55%	-0.28%	-1.2
16-9-2004	0.55	2.18%	2.26%	-0.08%	-0.1
Position as at 31-12-2004	13.15			**-0.15%**	**-89.7**

4.4. Possible explanation of the results

Both the expected and the realised savings are smaller than the inflation risk premium of 50-100 basis points estimated by Campbell and Schiller. Literature refers to this discrepancy as the 'valuation puzzle': cheaper in theory, but not in practice. The difference can be partly explained by the fact that Campbell and Schiller did not allow for the adverse effect of the limited liquidity of inflation linked bonds, the differences in supply and demand ratios, as well as the 'newness' of inflation linked bonds. According to Laatsch and Klein, who in 2003 carried out research into inflation linked bonds in the US, the costs of such 'disadvantages' may run up to 50 basis points.[24] They point out that the market probably becomes more efficient over time, which may increase the (net) benefit for the State.

The cost of illiquidity, newness, etc. estimated by Laatsch and Klein seem rather high. For example, the volume that can be traded in a single transaction without affecting the price is larger for inflation linked bonds than for private government bonds, whereas the bid-ask spreads are comparable. In addition, bilaterally tradable prices are quoted for inflation linked bonds on electronic trading platforms, which makes the trade in inflation linked bonds considerably more transparent than the trade in private government bonds.[25] Private government bonds are around 10 basis points more expensive than public government bonds. This makes it rather unlikely that the cost of differences in liquidity, supply and demand ratios and 'newness' would be 50 basis points for inflation linked bonds.

[23] Francis Laatsch and Daniel Klein (2003), Nominal rates, real rates, and expected inflation: results from a study of US Treasury Inflation-Protected Securities, the Quarterly Review of Economics and Finance 43, pp. 405-417

[24] Tradable prices and quantities are quoted on electronic platforms, so that inflation linked bonds can be bought/sold at a click of the mouse. On average, the volume that can be bought/sold in a single transaction amounts to € 10 million. The difference between the best bid price and asked price is 2 to 3 cents in the 5-year segment, 5-7 cents in the 10-year

Another explanation propounded is that the market has *persistently* underestimated inflation. If the actual rate of inflation is always higher than the expected rate of inflation (that is allowed for in nominal bonds), inflation linked bonds will invariably turn out more expensive. In that case, the expected premium will be overcompensated by the extra costs of the higher rate of inflation. This, however, is not plausible either.

The remaining explanation for the relatively modest benefits achieved is that Campbell and Schiller overestimated the inflation risk premium. This is possible because a part of the calculations applied implicitly presumes that inflation linked bonds, contrary to nominal bonds, are free of risk to the investor.

4.5. Comparison of cost and risk between inflation linked bonds and long-term debt

Although the issuance of inflation linked bonds is expected to generate a funding benefit, this entails a higher risk. Because of the one-to-one link between inflation and interest expenses, inflation linked bonds cause the annual interest costs to fluctuate, whereas the interest expenses are fixed for the entire term when nominal ten-year bonds are issued. In order to obtain insight into the relationship between, on the one hand, the expected funding benefit of 45 basis points in comparison with ten-year nominal bonds and, on the other, fluctuations in the interest expenses under different inflation regimes, simple calculations have been made on the basis of historical inflation data. The basic assumptions applied in this respect are that market parties can make a proper estimate of the average rate of inflation for a ten-year period, which leaves a funding benefit of 45 basis points. The calculations below only take account of inflation volatility. The consequences of an incorrectly estimated inflation level are therefore disregarded. That there is nevertheless an interest rate risk for inflation linked bonds is the result of inflation fluctuations around the ten-year average. Furthermore, it has been assumed for the purpose of the calculations that the inflation has a normal distribution.

Calculations based on Dutch inflation figures since 1965 show that the standard deviations of the year-on-year inflation during the seven reviewed (overlapping) ten-year periods amounted to a multiple of the expected funding benefit of 45 basis points. In order to have an indication of the yield/risk ratio, two calculations were made. The first shows in what percentage of cases inflation linked bonds would have been cheaper, with hindsight, for the periods reviewed (this number is always larger than 50%, owing to the basic assumptions of a funding benefit of 45 basis points and a normal distribution of inflation). The last column shows the ‘worst case’ funding loss of inflation linked bonds for the reviewed periods, with a reliability interval of 97.5%.

segment and around 10 cents in the 30-year segment. In comparison: of the 10-year DSL, € 100 million can be bought/sold within a 3-cent margin.

Table 4.4. Standard deviations of year-on-year inflation and their consequences for inflation linked bonds, 1965-2005

Period	Stand. dev. (bp) inflation (y-o-y)	% inflation linked bonds cheaper	Max. fin. loss (bp) (97.5% reliability)
1965 – 1974	215.7	58%	383
1970 – 1979	222.5	58%	397
1975 – 1984	234.5	58%	421
1980 – 1989	259.8	57%	470
1985 – 1994	145.1	62%	245
1990 – 1999	76.6	72%	110
1995 – 2005	91.0	69%	138

The results clearly show that in a high-inflation environment the funding benefit is fairly small in relation to the interest rate risks. As regards the period since 1990, however, inflation linked bonds would have been cheaper than ten-year nominal bonds in around 70% of the cases. Furthermore, the maximum funding loss in the last 15 years, amounting to 110 and 138 basis points respectively, is no longer ten times the expected funding benefit..

4.6. Comparison of cost and risk of a portfolio with and without inflation linked bonds

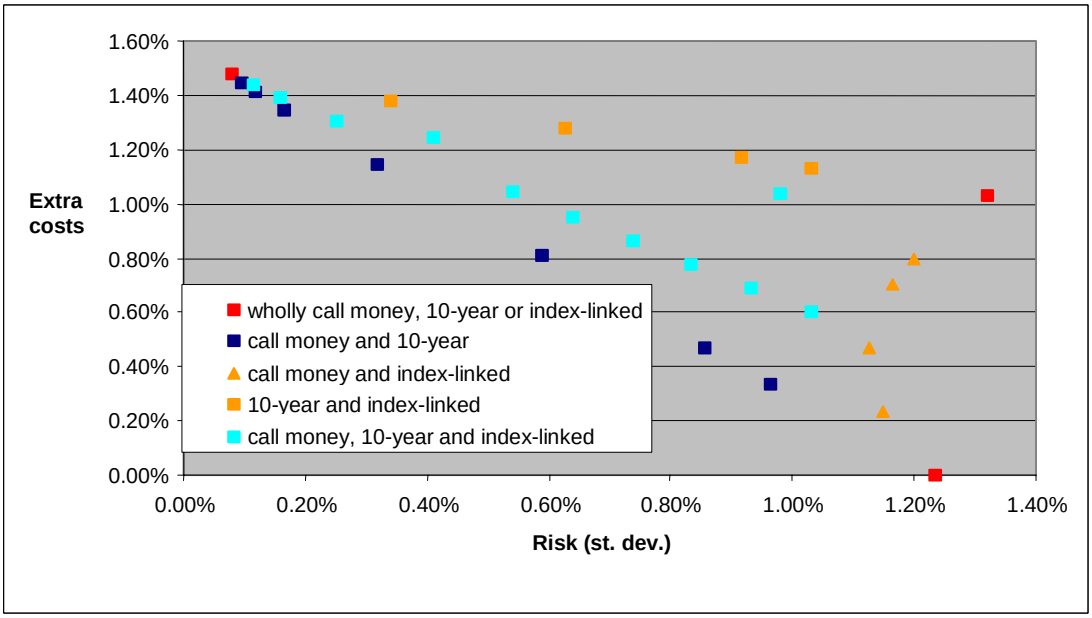
In the previous section, inflation linked bonds were only compared with nominal ten-year government bonds. In this section, however, the addition of inflation linked bonds to the existing funding instruments (treasury certificates and nominal government bonds) will be taken into consideration. Because of the annual adjustment of the interest rate (resulting from changes in the rate of inflation), inflation linked bonds cause fluctuations in the annual interest costs. This in contrast to long-term nominal bonds. Ten-year bonds give the State certainty about the cost level in the coming ten years. The uncertainty about the interest expenses only concerns that portion of the debt that has to be refinanced in any particular year. In a diversified term structure, this concerns 10% of the total outstanding debt. Just like inflation linked bonds, treasury certificates, with a term to maturity of 0-12 months, cause fluctuations in the annual interest costs. In order to form an opinion on whether the funding benefit of the inflation linked bonds is in proportion to the additional risk, the remuneration should be compared with the risk and the cost of existing funding instruments.

For this purpose, a so-called *efficient frontier analysis* was carried out.[26] The efficient frontier is the aggregate of issuance strategies (i.e. combinations of funding instruments issued) which, given a certain risk, entail the lowest expected cost for the State. The efficient frontier is obtained by calculating covariances and combining these with different issuance strategies, and the expected cost of these strategies. The figure below shows the efficient frontier on the basis of

[25] The calculations are based on call money rather than treasury certificates, owing to the availability of data. Because the difference between these interest rates is limited, this substitution does not affect the outcome.

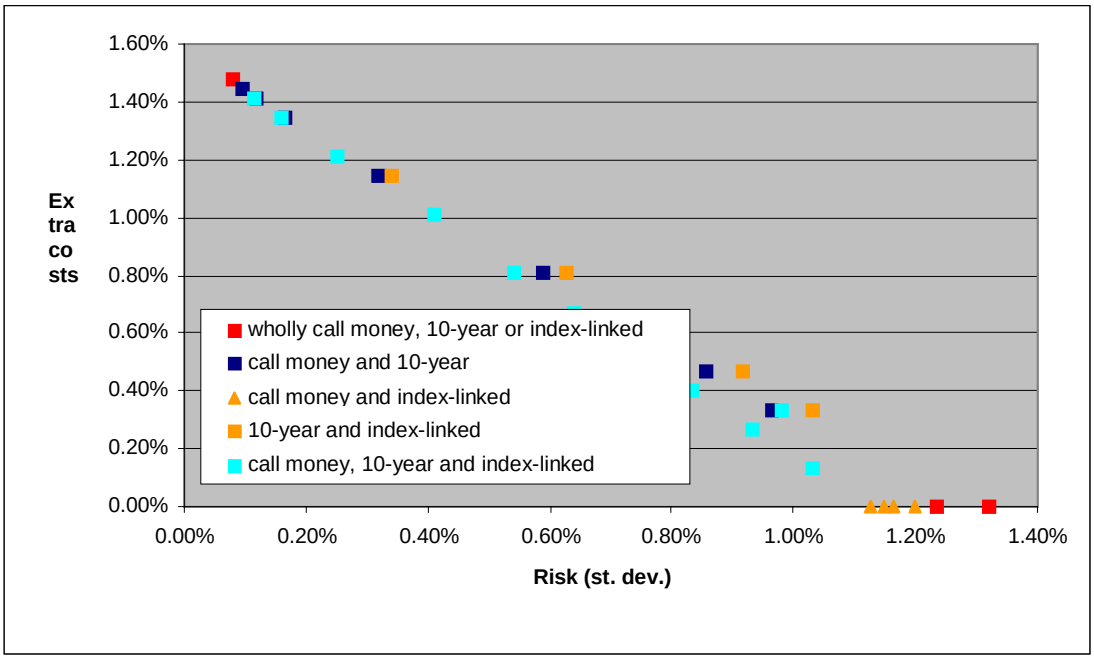
data for the period 1983-2004, under the assumption that the expected cost of inflation linked bonds will be 45 basis points lower than that of long-term debt (roughly equal to the recent ex-ante benefit in France and to the average ex-ante benefit in the UK over the last three years). In this situation, the issuance of inflation linked bonds is not attractive; the efficient frontier for the combination of treasury certificates and ten-year bonds is more efficient than any other combination that involves inflation linked bonds.

Figure 4.1. Efficient frontier (1983-2004)



The next question is what the benefit on the inflation linked bonds *should* be in order for inflation linked bonds to be part of an efficient portfolio. This can be calculated as follows. Let us assume, as a point of departure, that inflation linked bonds are just a cheap as treasury certificates. In that case, all efficient issuance strategies will contain inflation linked bonds (figure 4.2).

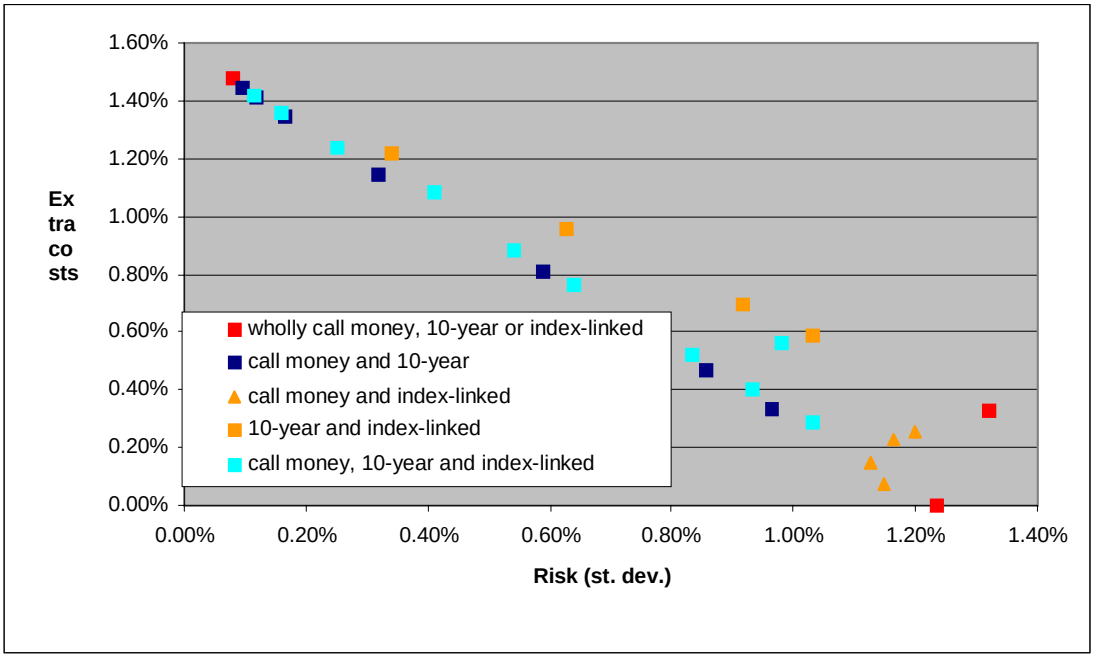
Figure 4.2. Efficient frontier if inflation linked bonds were as cheap as treasury certificates (1983-2004)



The above assumption is not realistic, but serves as a good starting point based on which the costs of inflation linked bonds can be gradually increased. The costs are increased until the issuance strategies involving inflation linked bonds coincide exactly with the efficient combinations consisting only of nominal bonds. The difference between the assumption 'inflation linked bonds are just as cheap as treasury certificates' and this scenario is the amount by which the costs of inflation linked bonds may exceed those of treasury certificates. After all, these costs are exactly compensated for by the diversification benefit (figure 4.3): a more efficient portfolio owing to the addition of inflation linked bonds.

Calculations show that the size of the expected diversification benefits greatly depends on the period over the covariances were calculated. When viewed over the period 1983-2004, the diversification benefits amount to around 30 basis points. During 1999-2004, on the other hand, there is a diversification loss. This loss was caused in particular by the increased volatility of inflation rates, while the short-term interest rates were less volatile (because they had been agreed at European level). Furthermore, the short-term interest rate moved in the same direction as the rate of inflation (and was therefore correlated to the rate of inflation).

Figure 4.3. Efficient frontier if inflation linked bonds were 30 basis points more expensive than treasury certificates (1983-2004)



The calculations also show that the diversification benefits can only be realised with unrealistic issuance strategies. Diversification strategies will be optimal if the effect on the interest costs of (i) refinancing of nominal bonds, (ii) treasury certificates and (iii) the outstanding volume in inflation linked bonds, is more or less equal. This greatly restricts the number of possible issuance strategies. In the current issuance strategy, refinancing worth around 10 billion euros takes place each year in all maturities. To achieve maximum diversification benefits, around 10 billion in inflation linked bonds has to be outstanding as well (this equals an annual issuance of € 1 billion). Because the funding need remains roughly the same, this means that the amount of treasury certificates should be reduced by € 10 billion. The annual issuance of inflation linked bonds is very limited, while the amount outstanding in treasury certificates is halved in size. The latter is not desirable, given the buffer function of short-term instruments for unforeseen changes in the funding need.

The uncertainty about the diversification benefits and the fact that they are only realised with unrealistic issuance strategies are reasons for disregarding such benefits. This simplifies the analysis, for in that case the risk/cost ratio of inflation linked bonds can be compared with a linear combination of treasury certificates and nominal ten-year bonds.

When viewed over the period 1992-2002, the funding benefit of treasury certificates in relation to long-term debt was 148 basis points (table 4.4). The volatility relevant to the State of the year-on-year change in the six-month interest rate has a standard deviation of 0.82. Inflation linked bonds will have an interest rate variability that corresponds to the volatility of the year-on-year change in

inflation. With a standard deviation of 0.64, this variability is around 20% lower than that of the six-month interest rate. For a nominal ten-year interest rate, the standard deviation is 0.58.

Table 4.5. Risk of short-term interest and inflation (monthly data, 1992-2002)

	NL CPI (1990=100)	Year-by-year change
Average	2.92	0.74
Standard deviation	0.94	**0.64**
Highest value	5.63	2.96
Lowest value	1.32	0.01
	6-month interest rate	
Average	4.47	1.11
Standard deviation	1.90	**0.82**
Highest value	9.87	3.71
Lowest value	2.07	0
	10-year	
Average	5.95	0.90
Standard deviation	1.14	**0.58**
Highest value	8.45	2.28
Lowest value	3.76	0.03

When funded through treasury certificates or inflation linked bonds, the year-on-year change (standard deviation) in the short-term interest rate and the rate of inflation affects the interest costs on the entire debt outstanding. When funding occurs with nominal ten-year bonds only, the uncertainty about the interest expenses only affects the part of the debt that has to be refinanced in any particular year. In a diversified term structure, this concerns 10% of the total outstanding debt.[27] The effect of the year-on-year change (standard deviation) of the nominal ten-year interest rate on the interest costs is therefore only 10%.

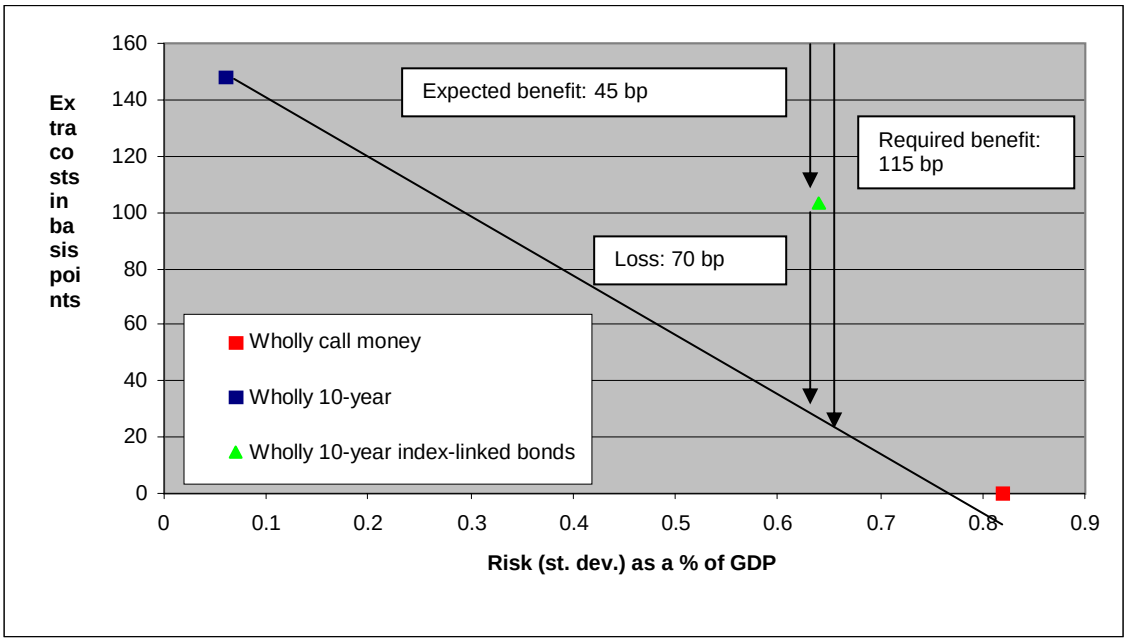
A linear interpolation of the above data results in the following. In order for the same risk/cost ratio to be realised for inflation linked bonds as for a combination of treasury certificates and ten-year bonds, the taking over the inflation risk should save the State 115 basis points (figure 4.4); in other words, 80% of the 148 basis points by which treasury certificates are cheaper than 10-year nominal bonds.

The figure below illustrates the results discussed above. The vertical axis shows the extra costs of instruments other than treasury certificates *in relation to* treasury certificates. The horizontal axis indicates the standard deviation. Treasury certificates are shown in the bottom right-hand corner: the volatility of the short-term interest rate has a standard deviation of 0.8 and treasury certificates entail no extra costs in relation to themselves. The nominal ten-year bond is shown in

[26] For reasons of simplicity, no account is taken of the fact that inflation linked bonds also require a revision of the real interest on the refinancing, which entails a small additional risk. This simplification does not change the conclusions, however.

the top left-hand corner; the relevant standard deviation is 0.058 (10% of 0.58) and the nominal bond costs 148 basis points more than treasury certificates. Inflation linked bonds are outside the efficient combination of short-term and long-term nominal instruments; the volatility of the year-on-year change in inflation has a standard deviation of 0.64 and inflation linked bonds are estimated to be 45 basis points cheaper than the ten-year nominal bond (i.e. 103 basis points more expensive than treasury certificates). Compared with the efficient combination of short-term and long-term instruments with *the same* risk as the index-linked bond, the costs of the index-linked bond are 70 basis points too high.

Figure 4.4 Comparison of cost and risk (1992-2002)



4.7. Summary and conclusions

Funding policy

The selection of instruments to finance the government debt increasingly involves a weighing-up of the cost and the risk of the various debt instruments. In a normal interest structure, funding the national debt with short-term debt instruments is superior from a cost perspective to funding with long-term instruments. On the other hand, funding with short-term debt instruments entails greater uncertainty about future interest payments. After all, short-term debt instruments will have to be refinanced earlier than long-term debt instruments, which increases the sensitivity of the interest costs to changes in the interest rate. The risk framework applied in the decision-making on the funding of the government debt (box 4.1) has been designed so that the interest costs remain under control even under extreme circumstances.

Determination of the business case

The risk framework offers the handles for the assessment of inflation linked bonds. In the case of an inflation linked bond, the rate of inflation payable on the principal sum is redetermined each year. To a certain extent this is comparable with short-term funding, where the interest rate is reset every year. Both instruments contribute to the amount at risk, because both instruments are exposed annually to changes in the interest rate. Treasury certificates entail a higher risk, however, because, in addition to the inflation risk, these notes also involve an annually recurring real interest rate risk, whereas inflation linked bonds have a longer term to maturity. In view of the fact that the variability of the nominal interest costs is most relevant when it comes to the funding policy, inflation linked bonds can nevertheless best be compared with short-term instruments. The question of the business case will thus be whether inflation linked bonds, adjusted for the difference in volatility between interest rates and inflation rates, are cheaper for the State than the issuance of treasury certificates.

Ex-ante saving of inflation linked bonds in relation to long-term debt

Ever since inflation linked bonds were first issued, it is possible to calculate the ex-ante benefit of inflation linked bonds in relation to long-term nominal bonds. Calculations along these lines for the US over the period 1999-2005 result in an average ex-ante loss for the State of 40 basis points. Where France is concerned, there initially also was an expected loss. In later years, there was an expected benefit. It seems that the market is pricing French inflation linked bonds increasingly efficiently. The average benefit over all reviews for France is 20 basis points. Over the last three years, the average benefit is 43 basis points. In the UK, there is an expected benefit as well. On average, this benefit is 35 basis points over all reviews and 46 basis points over the last three years. This is slightly higher than in France, which may be explained by the large differences in the supply/demand ratios between the UK and other countries.

If we use the above average experience data as a best guess for the Dutch situation, the issuance of inflation linked bonds versus long-term nominal bonds might yield an (ex-ante) benefit of 20 to 35 basis points. If we take the last three years as a benchmark, the benefit could amount to 43 (France) to 46 (UK) basis points. Obviously, the size of this benefit partly depends on the demand for inflation linked bonds.

Comparison of the risk/cost ratio: inflation linked bonds versus treasury certificates

During 1992-2002, the interest rate on treasury certificates was on average 148 basis points lower than the interest rate on 10-year bonds. By issuing treasury certificates, therefore, the State saved 148 basis points in relation to the issuance of ten-year bonds. Calculations by the Agency show that – adjusted by a risk factor – taking over the inflation risk would have to fetch the State 115 basis points. Up until now, the ex-ante cost saving of inflation linked bonds has been too small to realise the same cost/risk ratio as that pertaining to treasury certificates (or to any linear combination of treasury certificates and nominal long-term debt).

Table 4.6. Comparison of the cost of inflation linked bonds and treasury certificates (in %)

Expected benefit of treasury certificates in relation to long-term funding	1.48
Required benefit of inflation linked bonds in relation to long-term debt in order to realise the same cost/ risk ratio as a combination of treasury certificates and ten-year bonds	1.15
Average expected benefit of inflation linked bonds in relation to long-term nominal bonds until now	[0.20 – 0.35]
Idem, last three years	[0.43 – 0.46]
Disadvantage (-) of inflation linked bonds in relation to treasury certificates until now	**– [0.69** – **0.95]**

5. The demand from pension funds for inflation linked bonds

Whether the issuance of inflation linked bonds can become more attractive for the Dutch State depends partly on the demand for inflation linked bonds. A further development of the demand for inflation linked bonds can make the market more efficient and thereby the business case for inflation linked bonds more attractive. The demand for inflation linked bonds from pension funds in the Netherlands seems to be on the rise. It is well conceivable that the new regulations as laid down in the Financial Assessment Framework (FTK) stimulate this demand.

Apart from any advantages or disadvantages for the State's funding burden, the issuance of inflation linked bonds may have a positive external effect on the economy as a whole. Inflation linked bonds enable pension funds to cover themselves against unexpected inflation shocks. As long as pension funds index their pension entitlements, inflation linked bonds will enable them to reduce the mismatch risk between their assets and liabilities. This may contribute to the stability of the pensions sector and the economy as a whole. Indirectly, the government budget would benefit as well. In addition to an analysis of the demand for inflation linked bonds from the pension sector, this chapter therefore contains a brief exploration of positive external effects.

5.1. Financial Assessment Framework and Pension Act

The analysis of the demand for inflation linked bonds is somewhat complicated by the fact that it is difficult to determine exactly how pension funds will behave in the future under the new pension act. The considerations presented here are based on the pension funds' current behaviour and on an estimate of the future behaviour of these institutions, once the new pension act has entered into force.

The Pension and Savings Funds Act, which will be replaced by the Pension Act, determines the framework for the pension commitments made by employers towards employees and the related schemes and claims. The law has entrusted the prudential supervision of pension funds and insurers to the Pensions and Insurance Supervisory Authority of the Netherlands (PVK), which since 2004 is part of the Dutch Central Bank (DNB). The policy frameworks regarding the supervision of the pension funds have developed considerably in recent years. Their final element is the Financial Assessment Framework (FTK), heralding an update of the financial supervision of pension funds.

The philosophy behind the new supervision is protection of the participant. According to the FTK, pension funds should ensure adequate capital funding of their liabilities. The participant should be able to expect within reason that his pension will actually be paid out. The FTK makes the

relationship between available resources and commitments undertaken more transparent, thus offering an instrument for assessing the pension funds' financial position.

The FTK provides two different tests:

- ***The solvency test***. This test determines whether an institution has sufficient resources in relation to its current liabilities, both now and – with a high degree of certainty – in one year's time. To this end, the ratio between assets and liabilities (the so-called coverage ratio) is compared with a mandatory coverage ratio. DNB offers a standard method for calculating whether the coverage ratio satisfies the required level. To demonstrate that all obligations can be fulfilled in the short term, an internal model may be used instead of the standardised method, provided that this model has been approved by DNB. An important innovation in the valuation of the assets and liabilities is that the point of departure is no longer a fixed actuarial interest rate (4%), but an interest term structure. For a standard pension fund, the mandatory coverage ratio is around 130% of the liabilities as determined using the term structure (the technical reserve). This norm for the coverage ratio is based on the requirement that the financial position of pension funds should offer 97.5% certainty (for insurers this is 99.5%) that, measured over a one-year period, all commitments are covered. The solvency test also includes a check as to whether pension contributions cover the costs.

- ***The continuity analysis***. This analysis involves a check as to whether, in realistic long-term scenarios, an institution will continue to meet its liabilities – in other words: the solvency test – in the future.

Compared with the rules in the FTK (average mandatory coverage ratio of 130%), pension funds currently have an average funding shortfall of 8 to 10 percentage points. A number of pension funds have a coverage ratio of less than 105%. The law provides that if a pension fund's coverage ratio falls below the mandatory coverage ratio, the institution has to submit a recovery plan for lifting the coverage ratio to the required level within a maximum period of 15 years. If the coverage ratio is below 105%, the institution will have a maximum period of one year in which to repair the shortfall.

5.2. Implications of the FTK for indexation provisions

The pension funds' commitments include *all* unconditional claims which the pensioner can make against the pension fund (the indexation matrix shows when this will be the case). Adequate coverage should be available for all these commitments. In the average coverage ratio of 130%, no account has yet been taken of indexation obligations. If such obligations exist, the mandatory coverage ratio will be higher.

A fund may apply various forms of indexation: unconditional indexation, conditional indexation (as evidence of an indexation ambition), incidental indexation, or no indexation.[28] If a pension fund grants *unconditional* indexation in respect of the pension benefits, this commitment will be part of the liabilities and will therefore be subject to the solvency test. The mandatory buffer required will diminish as pension funds manage to match the indexation on the assets side. In case of conditional or incidental indexation, there is no extra solvency requirement.

5.3. Indexation and the role of inflation linked bonds

From the FTK it follows that inflation linked bonds may play a part in matching (on the assets side) the unconditional indexation obligations. If pension funds manage to match parts of their indexation obligations (i.e. unconditional indexation commitments granted to participants) with income flows on the assets side, the mandatory solvency ratio will be lower. Apart from the necessity to maintain a buffer under the rules in the FTK, pension funds may also want to match their indexation ambition.

There will be a perfect match[29] if (i) the index of the claim corresponds to that of the bonds and (ii) the compulsory, outgoing cash flows equal the incoming cash flows from inflation linked bonds. Many pension funds currently use a wage index in indexing pension entitlements. This may change in the future. In its present form, the index of the pension claims does not fully correspond to the index of the bonds (CPI), but it may be expected that there is a high degree of correlation between the two and that inflation linked bonds are a good instrument for realising such a match.

The demand for inflation linked bonds will subsequently depend on whether pension funds actually start matching (in full).[30] Pension funds are faced with an awkward choice here. This can be illustrated as follows. Let us assume that a pension fund grants unconditional indexation claims and that its commitments *including* these claims are currently covered in full by the value of a diversified portfolio of shares and nominal bonds. By replacing this portfolio by inflation linked bonds, the pension funds will have complete certainty also in the future that all its commitments are covered. The basis for determining the (cost-effective) contribution rate for new commitments will be the return on the assets portfolio, however. The expected return on a diversified portfolio of shares and bonds is higher than the return on a portfolio of inflation linked bonds. Matching (i.e. more certainty) will therefore require an increase in the contribution rates or a lowering of the ambition level.

By far the greatest number of pension funds currently choose to limit the claims by only offering *conditional* indexation. In terms of the FTK, the average mandatory coverage ratio remains 130%, based on the nominal liabilities. Nevertheless there is still sufficient demand for inflation linked

[28] A fund can also make firm indexation commitments at a lower aspiration level than fully index-linked or prosperity-linked, while aiming for additional indexation or granting incidental indexation.
[29] The term ‘perfect match’ may also be read as ‘perfect hedge’.

bonds, because a number of pension funds have maintained their unconditional indexation and want to match it. Others may also want to aim for a partial match for their indexation intentions.

5.4. Inflation linked bonds as a diversification instrument

Apart from a matching tool, inflation linked bonds may be attractive as a diversification instrument for the pension funds. This does not (necessarily) involve large quantities, but the inclusion of exactly the right amount of inflation linked bonds in order to achieve the maximum diversification benefits. The idea is that diversification of the portfolio at a level return will reduce volatility (the risk): the efficient frontier will move inward.[31] Inflation linked bonds may be used to reduce the risk if proceeds remain the same. Conversely, they offer scope for returning to the old risk level while realising a larger *return*, for instance through greater investment in shares. Pension funds currently use inflation linked bonds for diversification purposes in particular. In all likelihood this will continue to stimulate the pension funds' interest in inflation linked bonds also in the future.

5.5. External effects of the issuance of inflation linked bonds by the State

The working group has examined the interest and potential motives of pension funds in purchasing inflation linked bonds. The working group was given the impression that pension funds' interest has increased in recent years. In this connection, it should be pointed out that pension funds currently aim for matching to a limited extent only and use inflation linked bonds mainly as a diversification instrument. The incentives provided by the new Financial Assessment Framework to aim for better matching are not particularly strong either. As a result, the demand for inflation linked bonds on the part of pension funds will be smaller than might be expected as part of a matching strategy. Nevertheless, a sufficient demand for inflation linked bonds is expected even in the current circumstances. The picture may improve considerably in the future if pension funds were to alter their course and change over to matching.

The fact that there is a demand for inflation linked bonds from the pensions sector does not yet constitute sufficient economic justification for the issuance of inflation linked bonds by the State. This requires that the gains for society exceed the costs for society of the issuance of inflation linked bonds. In conformity with the terms of reference, the working group has not examined the possible positive external effects of the issuance of inflation linked bonds. Nevertheless, the potential external effects of the issuance of inflation linked bonds are briefly considered below by way of exploration.

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[30] In case of full matching, however, the supply could never meet the demand, given the size of the government debt and the diversification desired in funding this debt.

[31] Diversification benefits depend on the ratio between the various assets (short-term and long-term nominal bonds, inflation linked bonds, shares, property, etc.) in the portfolio. The price of inflation linked bonds seems to be determined in practice by comparing the risk of inflation linked bonds with the risk of nominal bonds only. That is, without taking any diversification benefits into account. It seems, therefore, that investors want diversification benefits but are not prepared to pay for them. This could be attributable to the fact that the diversification benefit (for both pension funds and the State) is unstable and time-related (it is not attractive to pay for this benefit in advance).

Issuance of inflation linked bonds may contribute to prosperity in that it eliminates a form of market failure, i.e. the absence of a market for inflation-proof titles. This is of particular importance in an ageing society with growing pension savings. The joint capital of the Dutch pension funds already exceeds 125% of the gross domestic product and will grow considerably in the future (see CPB pension study, 2004). This means that the proportion between premium base and pension commitments will become increasingly distorted, so that the effect of shocks on the capital will require increasingly large changes in premiums or claims. Greater premium volatility may cause disruptions in the labour market, while it will also affect government finances via the deferred taxation system and the premiums to the General Pension Fund for Public Employees (ABP). Uncertainty about the level of the future pension benefits will have a direct negative effect on prosperity.

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