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SAFFIER

A multi-purpose model of the Dutch economy for short-term and medium-term analyses

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Abstract

Since late 2004, CPB Netherlands Bureau for Economic Policy Analysis has been using the macro-econometric model SAFFIER for its short-term and medium-term analyses. This model resulted from the integration of the quarterly model SAFE and the yearly model JADE. SAFFIER is a multi-purpose model. The quarterly version of the model, used for short-term analyses, only differs from its yearly version, used for medium-term analyses, in the specification of the lag structures. All other (non-technical) specifications are identical in both versions of the model. Simultaneously with the integration of SAFE and JADE, some innovations with respect to the modelling of the wage rate, private consumption, exports, the public sector and the house-price development have been incorporated. In the wage equation, the elasticity of the replacement rate is no longer constant, but is depending on the actual labour-market situation.
This publication sketches the outlines of the SAFFIER model, focusing on the main innovations. In order to explain the working of the model, the results from a number of standard shocks are presented.

Key words: macro-econometric model, wage equation, simulations

Korte samenvatting

Voor analyses en ramingen op korte en middellange termijn maakt het Centraal Planbureau (CPB) sinds eind 2004 gebruik van het macro-econometrische model SAFFIER. Het model is ontstaan uit de integratie van het kwartaalmodel SAFE en het jaarmodel JADE. Bijzonder aan SAFFIER is dat sprake is van één model in twee hoedanigheden. De kwartaalversie van het model wordt gebruikt voor de korte-termijnramingen, terwijl de jaarversie bij middellange-termijnanalyses wordt ingezet. De kwartaal- en jaarversie van SAFFIER verschillen inhoudelijk alleen voor wat betreft de specificatie van de vertragingsstructuren. Alle overige (niet-technische) specificaties zijn in beide modelversies identiek. Tegelijk met de integratie van SAFE en JADE is ook een aantal inhoudelijke vernieuwingen aangebracht. Het gaat daarbij met name om de loonvergelijking, waarbij de elasticiteit van de replacement rate niet langer constant is, maar afhangt van de krapte op de arbeidsmarkt. Daarnaast bevat SAFFIER een geactualiseerd blok voor de collectieve sector en nieuwe vergelijkingen voor de particuliere consumptie, de (weder)uitvoer, de voorraadvorming en de huizenprijs.
In deze publicatie wordt SAFFIER op hoofdlijnen beschreven, waarbij het accent ligt op de belangrijkste inhoudelijke aanpassingen. De werking van het model wordt geïllustreerd aan de hand van twaalf spoorboekjes.

Steekwoorden: macro-econometrisch model, loonvergelijking, simulaties

Contents

Preface

Autumn 2004, the Netherlands Bureau for Economic Policy Analysis (CPB) started using the macroeconometric model SAFFIER. "SAFFIER" stands for "*Short- and medium-term Analysis and Forecasting using Formal Implementation of Economic Reasoning*". As the name suggests, the model is used for analyses and projections over the short and medium term. It is the successor to the quarterly model SAFE and the annual model JADE. What is special about SAFFIER is that it is a single model in two configurations: a quarterly version for short-term analyses, such as the CPB's *Central Economic Plan* and *Macro Economic Outlook*, and an annual version for medium-term analyses and calculations of the effects of policy proposals, election platforms and coalition agreements. This makes SAFFIER a multi-purpose model. Although there are some differences between SAFFIER's two model versions, it can certainly be regarded as one model, since the economic core, structure, nomenclature, data and infrastructure of the model versions are identical.

A model of the Dutch economy is never finished. Hence each publication of a large-scale econometric model can be no more than a snapshot. This is of course also true for this document. To keep the model description up to date over time, each significant model change will be added to this publication on the CPB's website (http://www.cpb.nl). If relevant, the 12 standard variants and scenarios discussed in this document will also be updated at regular intervals.

SAFFIER emerged from the integration of the SAFE and JADE models, and it builds on these models. During the integration an effort was made to retain the relatively strong features of each model and to incorporate them into SAFFIER. SAFE and JADE in turn were based on illustrious predecessors, such as FKSEC (1992), FREIA (1983) and KOMPAS (1983). Because of this history it is not possible to identify precisely which CPB staff members and former staff members contributed directly or indirectly to the development of SAFFIER. But clearly there have been many contributors. In addition to the two authors of this document, the following contributed to the integration project: Peter Broer, Frank van Erp, Free Huizinga, Paul de Jongh, Barthold Kuipers, Hans Lunsing, Ate Nieuwenhuis, Rocus van Opstal, Bert Smid, Martin Vromans and Paul Westra. Hans Stegeman dotted the proverbial i's in the document, and Erika Aarnoutse and Bart Borsboom were responsible for the layout.

Coen Teulings
Director

1 Introduction

The Netherlands Bureau for Economic Policy Analysis (CPB) started using a new macroeconometric model, SAFFIER, in the autumn of 2004. SAFFIER – which stands for "Short- and medium-term Analysis and Forecasting using Formal Implementation of Economic Reasoning" – is a multi-purpose model which can be used for short- and medium-term analyses. It is the successor to the quarterly model SAFE and the annual model JADE.[1] JADE was introduced in 1997, and has been used for medium-term analyses ever since then. SAFE succeeded FKSEC in 1999, and has since been used for short-term projections, such as the CPB's *Central Economic Plan* and *Macro Economic Outlook*.

SAFFIER is the latest branch in the CPB's thick model tree, but it will certainly not be the last. Don and Verbruggen (2006) provide an overview of what has preceded SAFFIER in terms of model building and model use at the CPB over the last 60 years.

Chapter 2 of this document explains why a new model was developed and how it relates to the two models on which it is based. Chapter 3 provides a broad outline of SAFFIER. This publication does not include a comprehensive description of all of SAFFIER's elements. For those elements which have not changed fundamentally from SAFE and JADE, we refer to the relevant model descriptions in CPB (2003b) and CPB (2003a). Chapter 4 considers a number of new and updated elements in SAFFIER, concentrating on the equations for wages, house prices and stock building. Chapter 5 devotes detailed attention to a large number of variants and scenarios. And finally, appendix A describes the key 50 equations in SAFFIER.

[1] See CPB (2003b) for a description of SAFE, and CPB (1997, 2003a) for a description of JADE.

2 Towards a new model

2.1 Backgrounds to SAFFIER

SAFFIER emerged from the integration of the annual model JADE and the quarterly model SAFE. During the integration, an effort was made to retain the relatively strong features of each model and to incorporate them into SAFFIER.

The annual model JADE was used to make medium-term analyses. This model paid considerable attention to the consistent deduction and estimation of behavioural equations on the basis of the latest insights of economic theory, in the conviction that this would enhance the analysis of economic-structure-oriented policy issues. This was an attempt to overcome some of the fundamental flaws in the macroeconomic models of the day, as identified by Sims (1980), namely the poor theoretical foundation of the individual equations and the econometric identification of the structural parameters.

The quarterly model SAFE was used for short-term projections. This model filtered out aspects which were not very relevant for short-term developments and focused on the short-term dynamics and correlations with empirical evidence. SAFE was oriented on the demand side of the economy, and did not contain a production function, for instance.

The original model versions of JADE and SAFE diverged sharply. But over the years the newer versions of both models steadily converged. Thus a production function was built into SAFE for the purpose of analyses relating to potential growth and the output gap, notions which were attracting considerable interest both in the Netherlands and internationally. And in JADE the distinctions between low- and highly-skilled labour on the one hand and the exposed and sheltered sectors of the labour market on the other hand were abandoned, because of the insufficient added value they offered. New research was also conducted on various model elements, the results of which were subsequently built into JADE and SAFE in virtually the same way. An example is the disaggregation of goods exports into re-exports and domestically produced exports. The convergence process between JADE and SAFE was further reinforced by the growing use of the “error correction model” (ECM) in both models.

Despite this convergence process, SAFE and JADE continued to yield different model outcomes. The coexistence of two macroeconomic models – one for the short term (1-2 years) and one for the medium term (4-8 years) – which did not fit seamlessly together sometimes led to awkward interpretation problems. Which model outcomes were the most relevant, and which model should be used for which analysis? These questions were all the more pressing because the short and the medium term flow into each other, and it was certainly possible to use SAFE to make calculations for three or four years ahead, or to use JADE to calculate outcomes for the

short term. Moreover, maintaining and managing two separate models which are very similar to each other is not an efficient use of resources.

That is why a study was conducted in early 2004 on the advantages and disadvantages of integrating JADE and SAFE. The main advantages identified were the disappearance of differences in outcomes between the two models, lower maintenance and management costs, fewer coordination problems between the two models, a broader knowledge and research basis, and a greater exchangeability of staff members. Against these advantages, however, some disadvantages were also identified, such as the greater complexity of the integrated model, because a single model would have to be able to describe both short- and medium-term economic developments. This greater complexity made the model somewhat less convenient to use. It would also be more difficult to adapt the model to new insights and developments, since the model changes would have to lead to plausible and better model outcomes not only over the short *or* medium term but over the short *and* medium term.

The result of this "cost-benefit analysis" was that the advantages were deemed to outweigh the disadvantages. Consequently it was decided to integrate the two models. This was done with the explicit intention of trying to preserve the practical usability for short-term analyses on the one hand and medium-term analyses on the other as much as possible.

2.2 A single model in two configurations

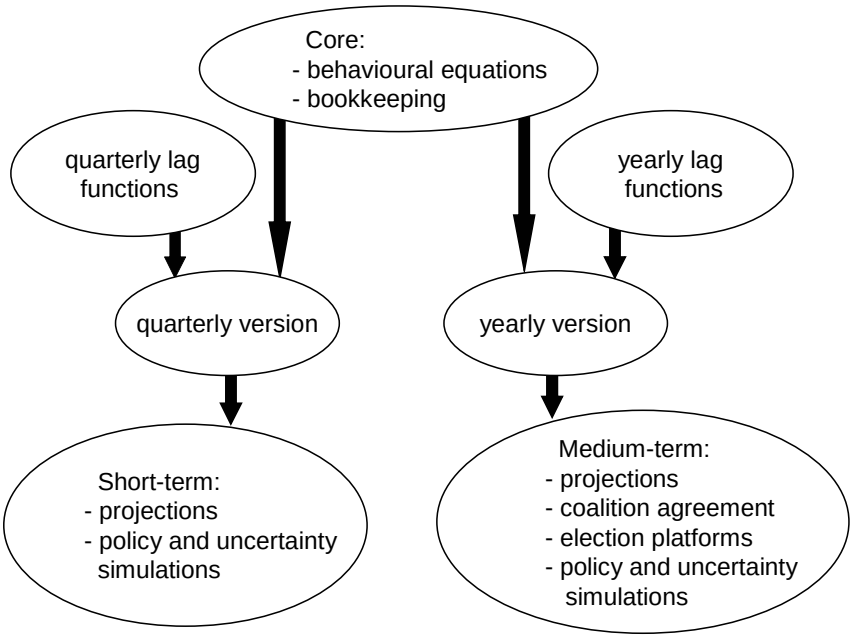
In effect the building of SAFFIER was based on the quarterly model SAFE and the short-term dynamics included in it. Various elements from JADE were then built into the new model to ensure that the new model would also generate plausible outcomes over the medium term. These elements include, for instance, the equations to determine price levels and the costs of capital. Furthermore, for analyses over the longer term, some model specifications diverge from those for the short term, such as in the case of structural import penetration, the structural market share loss of domestically-produced exports, the progression factor in taxes, and the determinants of house prices.

Towards the end of 2004 the integration project was completed with a new macroeconomic model which exists in both a quarterly version and an annual version. SAFFIER is therefore a single model in two configurations. As far as we know, this is a unique concept. The quarterly version is used for analyses and forecasts over the short term, that is to say at most two years ahead, as these are published in the CPB's *Central Economic Plan* and *Macro Economic Outlook*, for instance. The main advantages of the quarterly model lie in its ability to process available quarterly information on such aspects as economic growth, inflation and employment, and in its greater ability to model the economic relationship between variables over time.

The corresponding quarterly path is converted into an annual path, after which the annual version is used for analyses and forecasts over the medium term. The annual version is used in particular to calculate medium-term scenarios and the effects of election platforms, coalition agreements and policy options. Quarterly dynamics barely play a role in these contexts, because the calculations often concentrate on the effects by the fourth year. Moreover, in these applications the incorporation of government policy plays a more prominent role than e.g. the cyclical pattern of international developments. Quarterly information is not relevant in this case, and using the annual version has the major advantage of less technical complexity.

The core of the model is the same in both model versions. This core consists of all behavioural equations and all equations required for the national accounts framework.[2] Only that part of the model in which the lag functions are defined has two versions. The combination of the core model with the quarterly version of the lag functions results in the quarterly version of SAFFIER. The combination of the core model with the annual version of the lag functions results *mutatis mutandis* in the annual version of SAFFIER. This is shown schematically in figure 2.1.

Figure 2.1 Outline of SAFFIER



[2] The many equations which have been added solely in order to facilitate the analysis of the model outcomes – known as contribution equations – are also part of the model core. The division of equations into contributions has no influence on the model outcomes, however.

Besides the lagging structures, there is one other difference between the quarterly and the annual version of SAFFIER. This concerns what has been called the "factor 4" which occurs in many places in the model's quarterly version. This factor has been included in the core model through the frequency parameter *fp*. In the annual version this parameter is set at 1, and in the quarterly version at 4. This is discussed in greater detail in a box.

Apart from these more or less *technical* differences between the quarterly and the annual versions of SAFFIER, it is also possible for *substantive* differences to develop between the two model versions. This happens if regime dummies in the annual version are given a different value than in the quarterly version. By changing a regime dummy, it is relatively easy to create an alternative model version. Some of the regime dummies built into SAFFIER are intended to allow stable long-term growth paths to be generated with the model. This requires, for instance, the exclusion of the progression factor in taxes, the exclusion of trend terms in export equations, and house prices which are determined by the construction costs of new homes rather than demand factors. This is discussed in greater detail in section 5.1 and appendix C.

"Factor 4" and the frequency parameter (fp) in the quarterly model

Most of the parameters in the behavioural equations are estimated with annual figures. This means that they cannot be simply applied in a model using quarterly figures. The level variables in both model versions of SAFFIER are expressed on an annual basis, and the change variables are defined in terms of the immediately-preceding period. Therefore in the quarterly version the changes in volume terms are broadly one-fourth of the corresponding changes in the annual version. That is why an equation with both levels and changes needs to take account of what has been called the "factor 4". In the model's quarterly version the estimated parameters of level variables in equations relating to changes in variables have to be divided by four. This applies in particular to the ECM parameters and the constant terms in the short-term equations. Another example is the impact of the level of household wealth on the change in the volume of private consumption. What is more, in the annual version some parameters have to be multiplied by four. An example is the equation for stock building, which is estimated on a quarterly basis. And sometimes the "factor 4" is also required in definition equations. This relates in particular to variables which change on an annual basis. An example of this is the actual and projected inflation on an annual basis, which is required to calculate real interest rates and the costs of capital.

Without further adjustments, the short-term dynamics of SAFFIER's quarterly and annual versions tends to diverge somewhat, since in the quarterly version the error correction mechanism (ECM) comes into play already after the first quarter, *during* the first year in other words, while in the annual version it only comes into play *after* the first year. In order to ensure that the first- and second-year effects of both model versions still approximate as closely as possible, research has been conducted into the optimum specification of lag functions. The findings of this research are set out in Broer (2005).

The corresponding equations in the quarterly and annual versions of SAFFIER contain the same lag functions, also called the "g-functions". However, the content of the lag functions differ in the two model versions. The g-functions for the quarterly and annual versions of SAFFIER are set out in appendix B.

3 SAFFIER in brief

SAFFIER's core model consists of three major elements or blocks, namely the market for goods and services, the labour market and the public sector. The outlines of these blocks are sketched in the following sections, and several other features of the model are considered in section 3.4.

3.1 Market for goods and services

The block of the model which describes the market for goods and services contains behavioural equations for the endogenous components of final demand, namely private consumption, business investment and exports. Together with the largely exogenous public spending, these consumption categories constitute the final demand for goods and services.

In the modelling of private consumption a distinction is made between, on the one hand, households that have access to the capital market, which are deemed to behave according to the life-cycle theory, and, on the other hand, households which do not have access to the capital market, which are deemed to consume all of their disposable incomes.

Business investment (excluding dwellings and stocks) is a special expenditure category, because it not only constitutes part of the final demand, it also plays a major capacity-creating role on the supply side of the economy. A distinction is made between investments in industrial and commercial buildings on the one hand and machinery and transport equipment on the other. The volume of investments is determined by the production volume, the relative costs of capital and profitability. Production volume and relative costs of capital determine the optimum stock of capital goods in the market sector, with the relevant parameters derived from the CES production function.

In the modelling of goods exports, a distinction is made between domestically-produced exports and re-exports. The reasons for this are that the share of both components in total exports has changed structurally, and that both the explanatory variables and the economic effects of the two components differ substantially from each other. Thus "Made in Holland" exports are appreciably more price-sensitive than re-exports, and the prices of domestically-produced exports are determined far more by the costs of labour and capital than are the prices of re-exports, which are determined for approximately 90% by import prices.

Production in the market sector is determined by the final demand for goods and services. Part of the demand for goods and services originates from abroad, and the remainder is produced in the Netherlands. What proportion is obtained from abroad depends in part on the price balance between domestically-produced products and imports. The supply of goods and services by the market sector is described on the basis of a CES production function, with labour and capital as the production factors. If demand for goods and services diverges from what can be produced

under the normal utilisation of production capacity, then tensions will occur in the economy. For the goods and services market this tension is reflected in the capacity utilisation rate. This tension variable is one of the explanatory variables of selling prices, which contributes to the gradual easing of temporary or more prolonged tensions on the goods and services market. Selling prices are also determined by cost factors and by competitor countries' export prices.

3.2 Labour market

On the labour market the demand for labour, or employment, arises directly from the CES production function. Employment is determined by the production volume, relative labour costs, working hours and labour-saving technological productivity. The labour supply is largely determined by trend-based factors, such as demographical developments. Tensions on the labour market (such as through the "discouraged worker" effect) and developments in real disposable income also play a role. Unemployment is equal to the difference between the labour supply and employment, but at the same time it also has an impact on the labour supply and (via wages) on employment.

The explanation of wage rates, in the market sector is based on a right-to-manage model, in which wage rates are the outcome of negotiations between employers' associations and trade unions. Besides developments in inflation and labour productivity, a key factor which determines wages is the fallback position of workers who have been made redundant, which is determined by the "wedge", the replacement rate and the unemployment rate. An improvement in workers' fallback positions has an upward effect on wages. The influence of the unemployment rate on wages trends indicates that the labour market tends towards equilibrium over the long term.

3.3 Public sector

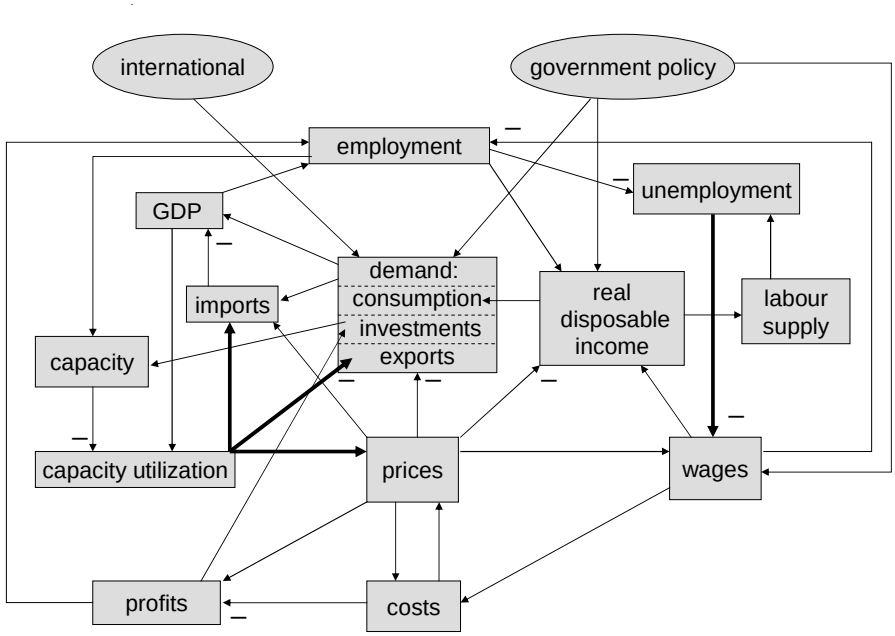
The public sector consists of the government in the narrow sense and the system of social security, including the health service. SAFFIER models the incomes and expenditures of both sectors. Most of the equations reflect institutional arrangements, not behaviour in other words. A deliberate choice has been made not to endogenise behaviour in the public sector, for several reasons. Firstly, policy preparation requires projections that include the policies proposed by the government. And secondly, in this way the implications of alternative or additional policies can be identified more easily. The latter also applies to the health service, although strictly speaking this is part of the market sector and not the government.

3.4 Other model features

3.4.1 Tension indicators and equilibrium mechanisms

The capacity utilisation rate and the unemployment rate are the traditional tension indicators for the goods and services market and the labour market respectively. The equilibrium mechanisms in the model run via these two tension indicators. In Figure 3.1, which shows the core relationships in SAFFIER, the first stages of these equilibrium mechanisms are marked by thicker lines.

Figure 3.1 Core relationships within SAFFIER[a]



[a] Thicker lines indicate the start of equilibrium mechanisms. Exogenous factors are shown in an ellipse, while wholly or largely endogenous factors are shown in a rectangle.

If the tension on the labour market intensifies, which is expressed in a falling unemployment rate, this will lead – as is usual in empirical macroeconomic models – via the Phillips curve to an upward effect on wages. Furthermore, in SAFFIER's non-linear wage equation (see section 4.1) the replacement rate has a smaller depressing effect on wages at times of low unemployment than at times of high unemployment. All other things being equal, the higher wages make the production factor labour more expensive and profits lower, which over time has a downward effect on the demand for labour. At the same time, the higher real wages encourage more people to join the labour market, increasing the labour supply in other words, so that supply and demand on the labour market will tend to converge. The restoration of equilibrium on the labour market also runs in part via the production side. Higher wages lead to

higher prices of domestically-produced exports, which undermines the Netherlands's price competitiveness and export performance. This also has a downward effect on the demand for labour. Against this, however, over the short term higher wages will spark additional private consumption, so that the restoration of equilibrium via the production side will be limited over the short term.

Potential growth and the output gap

For some time now, the output gap has been a popular tension indicator, in addition to the capacity utilisation rate and the unemployment rate. The output gap is equal to the difference between the actual and potential level of production volume, expressed as a percentage of the potential production level. Potential output is the sustainable level of production which can be achieved with the existing production structure, state of technology and available production factors.[a] Potential output and the associated output gap are estimated, unobserved variables, which are very important in determining the structural EMU balance, that is, the EMU balance adjusted for cyclical effects. There is no standard methodology for calculating potential output and the output gap. For instance, the method used by the European Commission differs in some aspects from the methods used by the OECD and the CPB.[b] Potential output and the output gap cannot be calculated with SAFFIER, in part because the required methods rely on complex filter techniques to determine the structural values of certain variables, such as the structural development of labour productivity. This cannot be squared with the character of SAFFIER. Both the European Commission method and the more advanced CPB method are used by the CPB. But this is done outside SAFFIER, with the help of a separate instrument.[c]

[a] See Don (2001) and Draper et al. (2001).
[b] See Kranendonk (2003) for an analysis of the differences between the CPB and European Commission methods.
[c] See Broer et al. (2006).

If the tension on the product market intensifies, which is expressed in a higher capacity utilisation rate, equilibrium mechanisms also come into operation. The higher capacity utilisation rate has an upward effect on the prices of domestically-produced goods and services, which thus become less attractive for customers at home and abroad. This depresses demand. At the same time the higher selling prices lead, all other things being equal, to higher profits, which has an upward effect on demand for the production factors labour and capital, resulting in a larger production capacity. What is called the "home pressure of demand" effect also plays a role in the restoration of equilibrium. Because of the strong demand for domestically-produced goods and services, there is less necessity for producers to sell on foreign markets, while domestic buyers, prompted by long delivery times, say, are more likely to look for potential suppliers abroad. Both effects suppress demand for domestically-produced goods and services, which helps to restore equilibrium on the product market.

3.4.2 Error correction mechanism

The Nobel Prize winners Robert Engle and Clive Granger have made a major contribution to the resolution of the question of whether it is better to formulate equations in terms of absolute levels or percentage changes. Equations in levels are particularly useful in analysing long-term

developments. It is true that equations in changes provide greater insight into the short-term dynamics, but there is no guarantee that they will reflect insights into the developments of the variables in question over the long term. To solve this problem, Engle and Granger proposed the "error correction model" (ECM). This is widely applied in SAFFIER. In this estimation method, the short-term equation (in changes) contains an "error correction term", which can be regarded as the difference between the actual and the long-term equilibrium level of the explanatory variable in the previous period. If the actual level is below or above the equilibrium level, this deviation or "error" will be partly corrected in the following period, because the error correction term has an upward or downward effect respectively on the percentage change of the variable in question.

The short-term equation is as follows:

$$\Delta \ln y = \alpha_1 \Delta \ln x - \varepsilon \ (\ln y - \ln y^*)_{-1} \qquad (3.1)$$

where:

y	endogenous variable (actual level)
y^*	long-term equilibrium level endogenous variable
x	exogenous variables
ε	'error correction'-parameter

The associated long-term equation is as follows:

$$\ln y^* = \alpha_2 \ln x + c \qquad (3.2)$$

where:

c	constant

Equations 3.1 and 3.2 can be estimated in two steps or in a single step. In the first case, the long-term equation (3.2) is estimated, and then the short-term equation (3.1), with the error correction term series equal to the estimation residue of the long-term equation. In the second case, the short- and the long-term equations are estimated dynamically – in one step, that is – by substituting equation 3.2 in equation 3.1. The two-step procedure is commonly used for estimating the behavioural equations in SAFFIER.

The error correction parameter ε indicates how quickly the actual level of the explanatory variable converges towards its long-term value. As ε is closer to 0 or 1, the adjustment process proceeds slower or faster respectively. To give some impression of the speed with which the

actual variable converges towards its long-term level, figure 3.2 shows the adjustment process for three different values of the error correction parameter (namely 0.10, 0.25 and 0.50).[3]

Figure 3.2 Adjustment process associated with three different error correction parameters

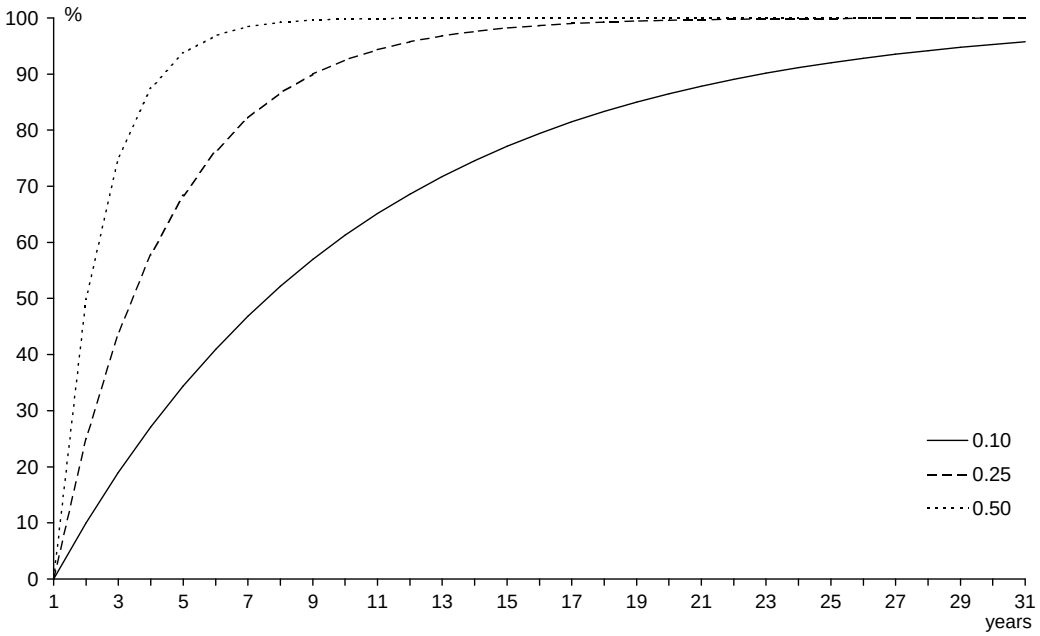


Figure 3.2 shows that with a parameter of 0.10, it takes nearly seven years for half of the difference between the actual and the long-term value to be corrected. With a parameter of 0.25 it takes around two-and-a-half years, and with a parameter of 0.50 half of the difference has already between corrected after one year.

It is also clear that the error correction mechanism alone can never fully eliminate the difference. Even so, over a specific period the actual and the long-term level can certainly correspond, but that will be because of other factors pushing the actual and the long-term values towards each other.

In the quarterly version of the model, it is not enough to divide all error correction parameters by four, or to replace ε by ε / 4 in equation 3.1. This is because the correction is applied to an ever-diminishing difference. In the most extreme case of ε = 1 on an annual basis, ε / 4 would yield an adjustment of 25% per quarter. After four quarters this would leave a residual difference of $(1–0.75^4)$, or 0.32%. In the quarterly version the adjustment per quarter must therefore be greater than ε / 4. The formula adopted to reflect this is $[1-(1-\varepsilon)^{1/fp}]$. In that case an ε of, say, 0.60 on an annual basis corresponds to 0.20 on a quarterly basis, rather than 0.15 (i.e. 0.60 / 4). In the annual model the frequency parameter (*fp*) is equal to 1 and the

[3] SAFFIER contains 30 error correction parameters, which range from 0.02 to 0.60 on an annual basis.

formula simply yields ε. For the sake of simplicity, we have decided not to use this formula in chapter 4 and appendix A, but to suffice with the simplified representation ε / *fp*.

3.4.3 Size

SAFFIER's core model consists of more than 2,600 equations. Around 50 of these relate to estimated or calibrated behavioural equations, the most important of which are set out in appendix A. The model also contains around 160 rules of thumb, which relate to such aspects as institutionally determined relationships, depreciation, and household wealth. These are relatively straightforward, unestimated equations which reflect relations between variables.[4] The overwhelming majority of the model's equations, namely around 2,400, are what are called "identities". Most of these are technical equations, definition equations and above all many contribution equations. The latter are included solely in order to facilitate the analysis of the model outcomes; they have no influence on the outcomes themselves. Altogether, SAFFIER contains more than 3,000 variables. In addition to the approximately 2,600 endogenous variables, the model contains about 250 exogenous variables and more than 200 autonomous terms.

[4] With regard to many variables determined on the basis of rules of thumb, more detailed equations are included in the various specialist models and algorithms used by the CPB, but it would go too far to include all of them in the macroeconomic model SAFFIER. When making projections, the results of these more detailed equations are incorporated into SAFFIER.

4 Main innovations

This chapter sets out the main innovations in SAFFIER. Because of the model outcomes' relatively great sensitivity to the specification of the wage equation, this will be considered first. Then the key changes in other elements of the model will be considered.

4.1 Non-linear wage equation

An important innovation compared to both JADE and SAFE has been made in the wage equation. The theoretical framework of the right-to-manage model has remained in place, but in SAFFIER a more general specification has been introduced into the application. The effect of an adjustment in the replacement rate has been made dependent on the tightness of the labour market. This gives the long-term wage equation a non-linear character. Section 4.1.1 explains this change in detail. Furthermore, the definition of the replacement rate has been changed, and a new series has been compiled for the "wedge".[5] Over the short term the development of wages has been estimated separately for the two components contractual wage and wage drift. In the short-term equation for the change in *contractual wages*, long-term *wage rate* is explicitly included as part of the error correction term (see section 4.1.2). In this way the three equations can be estimated simultaneously as a system with two equations.

4.1.1 Long term

As in SAFE and JADE, the negotiation model between employers' associations and trade unions provides the basis for the wage equation in SAFFIER. The underlying assumption is that, over the long term, wages in the market sector depend on productivity, the price of production (measured as value added), unemployment, the replacement rate and the wedge.[6]

$$p_l^{ms*} / p_y^{ms} = h^{ms} \frac{\beta}{u\ (1-rp-\Lambda)+\beta} \tag{4.1}$$

where:

p_l^{ms*}	long-term wage rate, market sector
p_y^{ms}	price of gross value added, market sector
h^{ms}	labour productivity, market sector
u	unemployment rate
rp	replacement rate

[5] See Stegeman (2002) and Bosch (2006) for further information on the series used for the wedge and the replacement rate respectively.

[6] See Graafland and Huizinga (1999) and CPB (2003a) for a more detailed explanation of this negotiation model.

Λ wedge

β measure of relative bargaining power of unions

The wedge (Λ) is expressed in real terms, and can be described as the quotient of real labour costs and real disposable wages. In SAFFIER the wedge term has been modelled in such a way that only changes in the wedge that come from changes in the tax and social security contribution burden on wage income (t_{wm} and t_{ww}) and changes in indirect tax rates (t_k) will have an effect on long-term wage trends.[7]

The replacement rate indicates what percentage of their net incomes workers will still receive on average after they have been made redundant and become reliant on benefit payments. The theoretical specification of the wage equation (4.1) expresses that the sensitivity of contractual wages to the replacement rate (rp) depends on the situation on the labour market, represented here by the unemployment rate (u).[8] For the sake of simplicity, a linear specification was used in JADE and SAFE, in which the elasticities were independent from each other, so that the replacement rate was not dependent on the labour market situation.

In reality, however, the chances of a worker being made redundant – and hence the relevance of the replacement rate – certainly does depend on the level of unemployment. After all, on a tight labour market workers are less likely to lose their jobs and are more likely to find new jobs than in a loose labour market with high unemployment. The fallback position of workers, as expressed in the replacement rate, will therefore play a smaller role in wage negotiations when the labour market is tight than when unemployment is high. For these reasons the estimated coefficients of the wage equation in JADE and SAFE were adjusted downwards on an ad hoc basis, using the simulations in the general equilibrium model MIMIC.[9] In order to take account of these factors in a more structured manner, the following non-linear specification of the wage equation has been derived and estimated on an annual basis in SAFFIER:

$$\ln(p_l^{ms*}) = \ln p_y^{ms} + \ln h^{ms} + \alpha_1 \ln \Lambda + \alpha_2 (u\_fp) \ln rp + \alpha_3 u\_fp + \alpha_4 \qquad (4.2)$$

[7] By deflating labour costs with the price of production and disposable wages with the consumer price index, the wedge could in principle change as a result of a change in the external terms of trade. However, such a change has no effect on long-term wages in SAFFIER, as it did not have in its predecessors JADE and SAFE either.

[8] This dependency on the labour market situation also applies to the impact of the wedge. Because this correlation was not empirically significant, it has been abstracted from this.

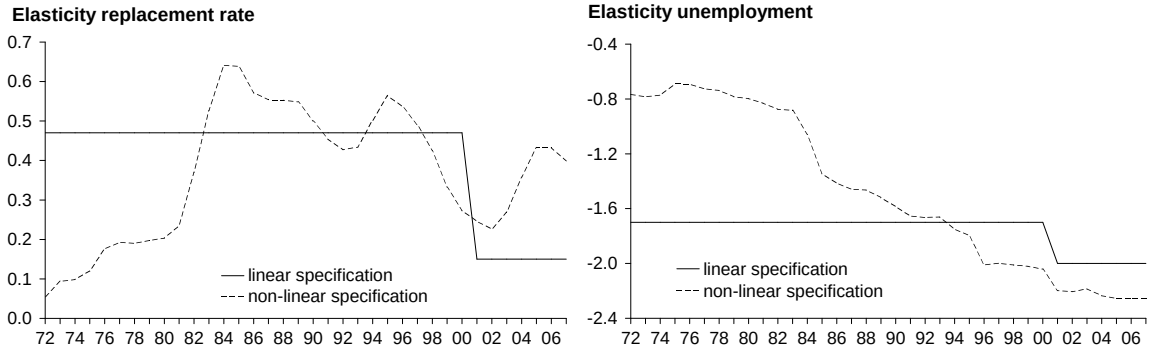
[9] See note 43 in the SAFE publication (CPB, 2003b).

Here *fp* is the frequency parameter, which is 4 in the quarterly version and 1 in the annual version (see box in section 2.2). The elasticity of the replacement rate thus becomes ($\alpha_2 u$). For unemployment the new elasticity is ($\alpha_3 + \alpha_2 \ln rp$). The outcome for the estimation of this long-term equation for wages is as follows:

$$\ln(p_l^{ms*}) = \ln p_y^{ms} + \ln h^{ms} + 0.19 \ln \Lambda + 7.02 (u\_fp) \ln rp + 0.51 u\_fp \qquad (4.3)$$

Over the long term, (changes to) production prices and labour productivity work through fully in (changes to) wages. The effects of changes in the replacement rate and unemployment on wage trends are no longer constant in the new specification, but vary over time. Figure 4.1 shows the elasticities of the replacement rate which can be derived from equation 4.3. It emerges that the elasticity of the replacement rate had fallen to 0.23 by 2002, because of the tight labour market, after which the loose labour market situation pushed it back up to 0.43 in 2005. Under the influence of the falling replacement rate the elasticity of unemployment has increased over the years (in absolute terms) from about 0.7 in the mid-1970s to more than 2 since the end of the 1990s.

Figuur 4.1 Elasticities in the replacement rate and unemployment, 1972-2007



Compared to the old specification, the coefficient of the wedge has been reduced from 0.34 to 0.19.

4.1.2 Short term

Wage trends over the short term are determined by three components: contractual wage rates, incidental wage rates, and employers' social security contributions. Simultaneously with the above-mentioned long-term equation, the following equations have been estimated for the short-term developments in the contractual wage rate (p_{lc}^{ms}) and the incidental wage rate (p_{li}^{ms}) in the market sector:

$$\overset{\circ}{p}_{lc}^{ms} = \overset{\circ}{p}_{y}^{ms} + 0.34\,\overset{\circ}{h}^{ms} + 0.70\,(\overset{\circ}{p}_{ci} - \overset{\circ}{p}_{y}^{ms}) + 0.11\,\overset{\circ}{twm} - 0.11\,\overset{\circ}{tww} + 0.22\,\overset{\circ}{rp}$$

$$- 0.52\,(u - u_{\_fp}) - \frac{0.40}{fp}(\ln p_l^{ms} - \ln p_l^{ms*})_{-1} \qquad (4.4)$$

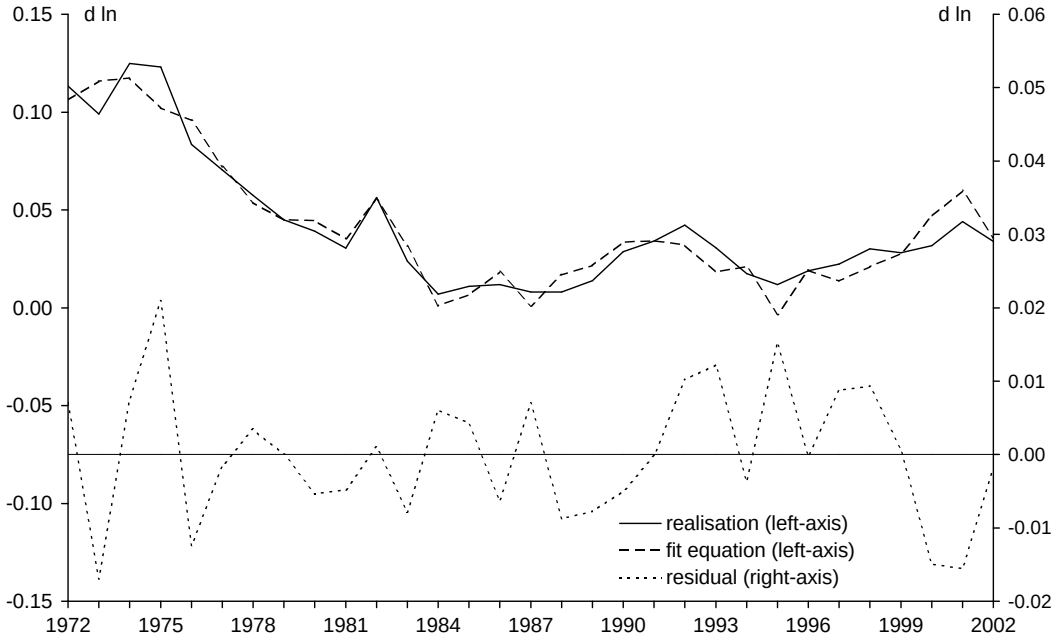
$$\overset{\circ}{p}_{li}^{ms} = 0.23\,\overset{\circ}{h}^{ms} - 0.04\,(u - u_{\_fp}) + \frac{0.05}{fp} \qquad (4.5)$$

where:

p_{lc}^{ms}	contractual wage rate, market sector
p_y^{ms}	price of gross value added, market sector
h^{ms}	labour productivity, market sector
p_{ci}	consumer price index
t_{wm}	employees' tax and premium burden on wage income
t_{ww}	employers' social security premium burden on wage income
twm	wedge variable relevant for employees: 1 / (1- t_{wm})
tww	wedge variable relevant for employers: 1 + t_{ww}
u	unemployment rate
p_l^{ms}	wage rate, market sector
p_l^{ms*}	long-term wage rate, market sector
p_{li}^{ms}	incidental wage rate, market sector
rp	replacement rate
fp	frequencyparameter: 4 in quarterly version and 1 in yearly version

The structure of the short-term equation for contractual wages is the same as that in SAFE and JADE. One new factor is that the short-term developments are also influenced by productivity trends.

Figure 4.2 **Contractual wage rate, actual and as estimated according to the equation for contractual wage rate (4.4), 1972-2002**



It also emerges that the error correction parameter, which indicates the speed of convergence towards the long-term level, has declined from 0.85 (in SAFE and JADE) to 0.40. Given the slowness with which wage rates tend to adapt to changes in labour market and other economic conditions, the new value definitely seems plausible.

4.2 Private consumption

The starting point of the current consumption equation in SAFFIER is the equation re-estimated in 2001, which was incorporated into both JADE and SAFE.[10] On the basis of this equation estimated for the period 1972-1999, the consumption trends in the years around the turn of the century are not easy to explain, however. The accuracy of the consumption projection left something to be desired, therefore. The CPB did not try to ignore this problem.[11] Further analysis resulted in three adjustments in the short-term equation, all of which have to do with the way in which changes in household wealth affect consumption trends.

The first adjustment relates to the addition of a revaluation term for households' stock of wealth. The original short-term equation only included a revaluation term for household's housing wealth. The addition of a revaluation variable means that private consumption trends are affected not only by changes in households' stock wealth, but also by the acceleration or

[10] See Kranendonk and Verbruggen (2001).

[11] See e.g. the CPB's *Macro Economic Outlook 2002* (pp. 27 and 84) and Kranendonk and Verbruggen (2002).

deceleration of changes in wealth. The upshot is that the "wealth effect" on consumption growth is somewhat greater over the short term than over the longer term.[12]

The second adjustment relates to the degree to which and the time lags with which changes in stock wealth impact on private consumption. In the original equation an increase in stock wealth in absolute terms had the same impact as a commensurate fall in stock wealth, so that the wealth effects were symmetrical. However, recent microeconomic research by Berben, Bernoth and Mastrogiacomo (2006) shows that Dutch consumers react appreciably more strongly to a fall in share prices than to a comparable increase. The reaction to a price fall is nearly three times as strong as to a price gain.[13] The explanation for this phenomenon offered by the psychological economic literature is that people are more affected by losing something they already possess than by not gaining something they do not yet possess. This has been called the "endowment effect". To take account of these asymmetric effects, it was decided in mid-2002 to raise the coefficient for the shareholdings term (from 0.033 to 0.054) and to reduce the average time lag (from 3½ to 1½ quarters) in the short-term equation *for years with sharp share price falls*. In these years this alternative shareholding term replaces the original estimated term.[14]

The third adjustment relates to the reduction of the sensitivity of consumption trends to changes in housing wealth.[15] The background to this is the introduction of the additional loan regulation (bijleenregeling) on 1 January 2004, which makes the withdrawal of home equity for consumption less attractive in tax terms.

The long-term consumption equation has not changed. For details, see appendix A and CPB (2002, 2003). The regular short-term equation for private consumption in SAFFIER is as follows:

[12] The coefficient of the revaluation term is such that the ratio between the coefficients for the wealth term and the evaluation term is the same for shareholdings as for home equity.

[13] These outcomes are in line with the research findings by Mastrogiacomo (2006) into the perceptions surrounding changes in wealth. This study found that households report a "sharp increase" in wealth when they have become nearly EUR 10,000 better off on average, while they already report a "sharp decrease" in wealth when their assets have fallen by EUR 3,500 in reality.

[14] The alternative coefficient and time lag are determined on the basis of what is called a "contribution analysis" of the equation and not by means of a new econometric estimation. The latter is not possible on the basis of a time series analysis because of the very few years in which share prices fall.

[15] The marginal consumption ratio of households' housing wealth has been reduced from 0.046 to 0.035, and the coefficient of the revaluation term from 0.035 to 0.025. Both coefficients now virtually coincide with the corresponding coefficients for stock wealth.

$$\overset{\circ}{c}_{vr} = 0.55\frac{g_6 \Delta lda_k}{(C_{vr})_{-1}} + 0.69\frac{g_{16}\Delta oda_k}{(C_{vr})_{-1}} + 0.37\frac{\Delta zda_k}{(C_{vr})_{-1}} - 0.60\Delta r_{\ln} + \frac{0.025}{fp}\frac{g_{13}\Delta hw}{(C_{vr})_{-1}}$$

$$+ \frac{0.035}{fp}\frac{g_{13}(\Delta w^h_{-2})}{(C_{vr})_{-1}} + \frac{0.025}{fp}\frac{g_{13}\Delta ha}{(C_{vr})_{-1}} + \frac{0.033}{fp}\frac{g_{13}(\Delta w^a_{-2})}{(C_{vr})_{-1}} + \frac{0.054}{fp}\frac{g_{13}(\Delta w^r_{-2})}{(C_{vr})_{-1}}$$

$$- \frac{0.15}{fp}\ln(\frac{c_{vr}}{c^*_{vr}})_{-1} \qquad (4.6)$$

In case of a substantial fall in share prices, the term $\frac{0.033}{fp}\frac{g_{13}(\Delta w^a_{-2})}{(C_{vr})_{-1}}$

is replaced by $\frac{0.054}{fp}\frac{g_{15}(\Delta w^a_{-1})}{(C_{vr})_{-1}}$.

where:

c_{vr}	free private consumption
c^*_{vr}	longterm free private consumption
lda_k	disposable households' wage income
oda_k	disposable households' benefit income, excluding transfers related to medical expenses
zda_k	disposable households' profit income
r_{ln}	long-term interest rate net of taxes: $r_{\ln} = (1 - tcl - psl)\, r_l$
tcl	rate of direct taxes paid by labour
psl	social security contribution rate for employees
r_l	long-term interest rate
fp	frequencyparameter: 4 in quarterly version and 1 in yearly version
hw	revaluation of households' housing wealth (Δw^h)
w^h	households' housing wealth
ha	revaluation of households' stock wealth (Δw^a)
w^a	households' stock wealth
w^r	other assets of households

4.3 Exports of goods and services

In 2004, goods accounted for 78% of total exports and services for 22%. Because of the revision of the national accounts, the share of services in total exports has increased substantially. In SAFFIER, goods exports are divided into manufactures and energy. And within the exports of manufactures, a distinction is made between re-exports and domestically-

produced exports.[16] Re-exports are goods which are imported into the Netherlands and leave the country again without any further or very little further processing.[17] The trend-based increase in the nominal share of re-exports in total goods exports has been accelerating since 2003. The expectation is that in 2007 the value of re-exports will exceed that of domestically-produced or "Made in Holland" exports for the first time. In volume terms, the share of re-exports in total goods exports has increased even more, because over the past decades the prices of re-exported goods lagged well behind the prices of domestically-produced goods.

The volume trends in energy exports are exogenous in SAFFIER, as they were in its predecessors. The equations for domestically-produced exports, re-exports and exports of services have all been modified compared to SAFE and JADE. The modified equations are discussed below.

4.3.1 Domestically-produced exports

Conducting empirical research into the explanation of domestically-produced exports is no bed of roses. This is true of the long-term equation in particular. Among the issues which arise in this context are whether and to what extent the prices of "Made in Holland" exports can permanently diverge from those of competitor countries, and whether over time the volume of this type of exports is determined by the volume of world trade or by production capacity. Or to put it differently, to what extent are producers of tradable goods in a small, open economy like the Dutch economy price followers on the world market?

Empirical research into these kinds of issues immediately runs into a broad range of data-related technical problems.[18] These start with the most crucial series, namely the volume and price of relevant world trade, competitor countries' exports and production capacity specifically available for exports. These key variables are not observed and have to be constructed. In determining the volume and price series for relevant world trade and competitor countries' exports, the CPB uses several international data sources, but these are far from perfect in terms of consistency, completeness and definition. The division of the respective nominal figures into volume and price terms is especially difficult. One issue here is how quality improvements (in computers, for instance) are expressed in the series. Determining the volume of "doubly reweighted" or "relevant" world trade is also far from simple and requires further analysis. One of the challenges this gives rise to is how to divide the existing series in a doubly reweighted world trade which represents the relevant market size for domestically-produced exports, re-exports and exports of services respectively. The empirical research into export equations inevitably works with approximations of such series, which will affect the estimation results.

[16] For a detailed explanation of the backgrounds to this distinction, see the CPB's *Macro Economic Outlook 2002* (section 6.2) and Kusters and Verbruggen (2001).

[17] However, the goods must have been owned for some time by a Dutch-based company. If this does not happen and if no industrial processing takes place, then Statistics Netherlands (CBS) defines this as "transit trade", which is kept wholly outside the national accounts. See Roos and Exel (2006) for a detailed examination of the CBS's definition of re-exports.

[18] The data-related technical problems identified below are generally even more pronounced in the exports of services than in the exports of goods.

Apart from data-related technical problems in empirical research into domestically-produced exports, the following econometric issue also plays a role. In a number of submarkets the products are highly substitutable, so that one might expect the prices of domestically-produced products to coincide broadly with those of foreign competitors. In that case, one can expect on theoretical grounds a high or even infinite price elasticity in absolute terms. In practice, however, the estimated elasticities are often small. If the price differences are due solely to measuring errors and other statistical noise, then each price elasticity can be identified empirically. Thus a paradoxical situation may arise in which the explanation of a low estimation of price elasticity lies in a perfect market operation, in which exporters, owing to the high price sensitivity of sales, are not able to vary their prices from those of their competitors.[19] Now by no means all submarkets are characterised by good or perfect substitutability, but this is the case for a considerable number of products. Consequently the empirically-estimated price elasticity in the long-term equation at macroeconomic level is probably an underestimate of the actual situation.[20]

At the present moment, the CPB is conducting basic research on several fronts into the export equation and the export performance of Dutch exporters. Both the practical data and the theoretical specification are being examined. Early preliminary results seem to suggest that the empirically frequently-observed "Tinbergen 2" for price elasticity may be on the low side. Anticipating the research findings, the model of SAFFIER outlined here sets the long-term price elasticity at –4 on an ad hoc basis. In the estimated equation for domestically-produced exports included in JADE and SAFE, this elasticity was –2.58.[21] The short-term equation has not been changed compared to that in SAFE and JADE.

The long- and short-term equations for domestically-produced or "Made in Holland" exports are as follows in SAFFIER:

$$\ln bfb^{*} = 1.0 \ln mwf - 4.0 \left(\ln p_{bfb} - \ln p_{bfc} \right) - 0.008 \left(tr_{70} \right) \tag{4.7}$$

$$\begin{aligned} \overset{\circ}{bfb} = {} & 1.05 \overset{\circ}{mwf} - 0.76 \left(\overset{\circ}{p}_{bfb} - \overset{\circ}{p}_{bfc} \right) + \frac{0.54}{fp} g_2 \left(i_{qn}^{vi} - i_{qn}^{bu} \right)_{-fp} + \\ & - 0.41 \, g_3 \left(\Delta qy^{vi} \right) - \frac{0.18}{fp} \left(\ln bfb - \ln bfb^{*} \right)_{-1} \end{aligned} \tag{4.8}$$

[19] See Ederveen (2000).

[20] See also Hertel et al. (2004) and Lejour et al. (2006).

[21] See Kusters, Ligthart and Verbruggen (2001) for a description of the export equation. The standard error for the estimation coefficient in question is 1.04. This implies that a coefficient of –4 falls well within the 95% reliability interval. In the estimated long-term equation the trend term is –2.4. Subsequently, new time series (published by the CBS) have been included in SAFFIER's data model, after which the trend term has been calibrated in such a way (at –0.8) that the average residue of the long-term equation is around zero.

where:

bfb	exports of domestically manufactured goods
*bfb**	long-term level of domestically produced exports of goods
mwf	relevant world trade
p_{bfb}	price of domestically produced exports of goods
p_{bfc}	price of competitors' exports
tr_{70}	trend, starting in 1970 (1970=1, 1971=2, 1972=3 etc.)
i_{qn}^{vi}	investment ratio manufacturing industry
i_{qn}^{bu}	weighted average of i_{qn}^{vi} in competing countries
qy^{vi}	capacity utilisation rate manufacturing industry
fp	frequencyparameter: 4 in quarterly version and 1 in yearly version

4.3.2 Re-exports

The share of ICT-related products, such as computers, televisions and mobile telephones, in Dutch re-exports is substantially larger than their share in domestically-produced exports. When sales of ICT products plummeted at the start of this decade, it emerged that the original equation for re-exports did not take sufficient account of the fact that the mix of re-exports diverged widely from that of domestically-produced exports. This has been taken into account in the updated equation for re-exports by including – in the absence of a series of relevant world trade *for re-exports* – a new variable in the equation, namely the sale of semiconductors.
The short-term equation for re-exports is as follows:[22]

$$\overset{\circ}{bfm} = 0.76\,\overset{\circ}{mwf} + 0.32\,(\overset{\circ}{mws} - \overset{\circ}{mwf})*dum_s - 0.35\,(\overset{\circ}{p}_{bfm} - \overset{\circ}{p}_{bfc}) + 0.12\,\Delta\,(tr_{93}) + \\ -\frac{0.43}{fp}(\ln bfm - \ln bfm^*)_{-1} + 0.065\,\Delta\,dum_{88} \tag{4.9}$$

The long-term equation for re-exports is as follows:

$$\ln bfm^* = 1.0\ln mwf + 1.0\,(\ln mws - \ln mwf)*dum_s - 0.56\,(\ln p_{bfm} - \ln p_{bfc}) + \\ +0.12\,dum_{88} + 0.045\,tr_{93} \tag{4.10}$$

where:

bfm	re-exports
*bfm**	long-term level of re-exports
mwf	relevant world trade (competing exports excluding energy, doubly reweighted)
mws	international trade of semiconductors
p_{bfm}	price of re-exports

[22] See Mellens (2004).

p_{bfc}	price of competing exports excluding energy, doubly reweighted
tr_{93}	trend since 1993 (1993=1, 1994=2, 1995=3 etc.) related to the integration of the EU-market
dum_{88}	dummy since 1988=1, before that 0
dum_s	dummy correction semiconductors (since 1996=1, before 0)

Over the long term the volume of re-exports is determined entirely by the international trade in semiconductors. The underlying idea is that most of the re-export products, such as electronic equipment, mobile telephones, machines and computers, contain semiconductors. Although it is possible for developments in re-exports and the international trade in semiconductors to be out of step over the short term (owing to stock effects, for instance), over the long term a change in semiconductor sales will translate fully into a change in re-exports. Semiconductor sales can thus be regarded as an approximation of relevant world trade *for re-exports*. In SAFFIER, developments in semiconductor sales are linked with a simple rule of thumb to developments in relevant world trade.[23]

With a coefficient of 0.32, the importance of semiconductor sales is much smaller over the short term. Together with the error correction model parameter of 0.43, this means that it takes around one-and-a-half years for a change in semiconductor sales to fully work its way through into re-exports. This is because semiconductors are semimanufactures, and it takes some time before the goods in which these semiconductors are incorporated are produced and traded. After all, it is not the semiconductors as such which form part of re-exports, but the goods into which these semiconductors are incorporated.

As in the original equation in SAFE, in SAFFIER the price sensitivity of re-exports is considerably lower than that of domestically-produced exports.

4.3.3 Exports of services

Exports of services include, for instance, the exports of commercial services, services in the sphere of transport, storage and communication, and spending by foreign tourists in the Netherlands. The JADE specification has been used in SAFFIER. This sets the elasticity of world trade at 1.0 and the long-term price elasticity at −1.65.

The short-term equation for the exports of services is as follows:

$$\ln bd^{*} = 1.0 \ln mwf - 1.65 \left(\ln p_{bd} - \ln p_{bdc} \right) \qquad (4.11)$$

The long-term equation for the exports of services is as follows:

[23] This rule of thumb, which is used to determine the impulses of uncertainty variants in which relevant world trade receives a shock, is as follows: Δ ln mws = 1.8 Δ ln mwf.

$$\overset{\circ}{bd} = 1.0\,\overset{\circ}{mwf} - \frac{0.33}{fp}(\ln bd - \ln bd^{*})_{-1} \qquad (4.12)$$

where:

bd	volume exports of services
*bd**	longterm level of exports of services
mwf	relevant world trade
p_{bd}	exportprice services
p_{bdc}	exportprice services competitors
fp	frequencyparameter: 4 in quarterly version and 1 in yearly version

The competitor countries' export prices for services is a new variable in the model. The development of these competitors' prices is linked with a rule of thumb to price trends in services imports.

4.4 Stock building[24]

Besides the better-known expenditure categories such as consumption, investment and exports, the gross domestic product (GDP) is also determined over the short term by stock building, or the change in stock levels. Since the short-term projections concentrate on GDP *growth*, what matters in this context above all is the *change* in stock building.

The share of stock building in GDP amounts to only around 0.5% on average. But that does not mean that stock building is unimportant in the context of economic growth. Over the short term, stock building is highly volatile. The variations in changes in stock levels account for no less than half the variations in GDP. The high volatility of stock building means that this can actually make a considerable contribution to GDP growth in certain years. It is true, however, that in the Netherlands around half of the changes in stock levels tend to originate from abroad, and hence do not contribute to domestic output.

According to the stock equation in SAFFIER, businesses use stocks primarily as buffers to cope with shocks in sales (this is known as "production smoothing"). At the same time businesses also want to have a fixed share of sales in stock in order to avoid having to disappoint customers (this is called "stockout avoidance"). Businesses will also step up production, and thus increase stock levels, when production costs are low, and vice versa (known as "cost smoothing"). And finally, businesses will increase or reduce stock levels depending on changes in stock-holding costs.

In contrast with all other behavioural equations, the stock equation is estimated on the basis of quarterly figures. Stock building is expressed in seasonally-adjusted figures in constant 2001 prices as extracted from the quarterly national accounts.

[24] This section is based on Kuipers (2006).

The stock equation is as follows:

$$n = 0.58\ n_{-1} + 0.11\ fp\ g_{13k1}\ (\Delta vc) - 0.08\ fp\ \Delta vc - 0.02\ fp\ g_{13k1}(\Delta r_v) + \qquad (4.13)$$

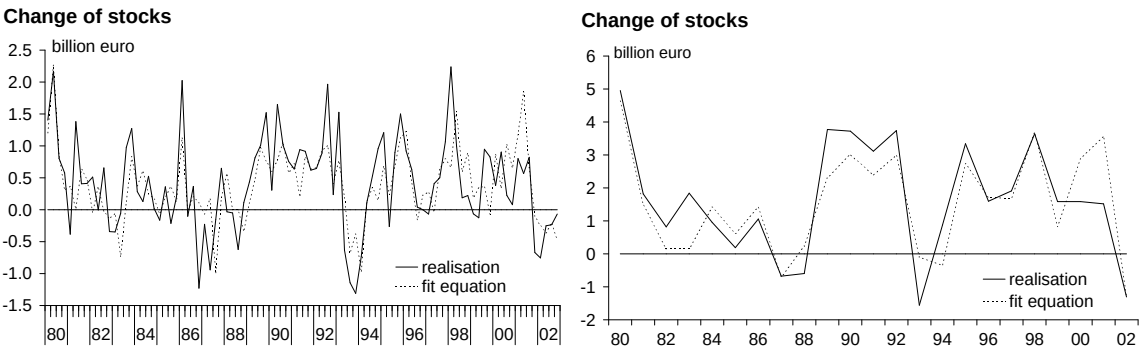
$$-17.50\ fp\ \overset{\circ}{p}{}_k^n + 9.70\ fp\ g_{13k1}(\overset{\circ}{p}{}_k^n)$$

where:

n	stock building
fp	frequencyparameter: 4 in quarterly version and 1 in yearly version
vc	domestic sales and exports
r_v	real interest rate, relevant for stockbuilding
p_k^n	production costs of stock building

Figure 4.3 shows that this equation describes stock-building trends reasonably well.

Figure 4.3 Fit between the stock equation on a quarterly basis (left) and an annual basis (right), 1980-2002



The estimates show that over the very short term an increase in sales leads to a reduction in stock building. Businesses adjust their production levels gradually. Over the somewhat longer term there is a positive correlation between sales and stocks, because businesses want to have a fixed percentage of sales in stock. In other words, over the somewhat longer term stock building behaves procyclically. An increase in sales eventually boosts stock levels by 7%, i.e. (0.11 – 0.08) / (1– 0.58). Since stocks account for around 8½ % of final sales, the estimated equation implies that the stock ratio will nudge down further over the long term. Plausible reasons for this are more efficient stock management and the shift from goods production to service provision in the economy.

An increase in production costs tends to depress stock building, while an increase in projected production costs will boost it. Businesses also tend to reduce their stock levels when real interest rates are rising. The estimated effects of production costs and interest rates are small, however.

4.5 House prices

The equation for house prices was reviewed in 2005. Since then it has contained new elements compared to the simple specification included in SAFE and JADE.[25] Previously, house prices were linked to the investment prices for homes. In the new version, supply and demand elements play a larger role. The long-term equation for real house prices includes as explanatory variables household real disposable income, household financial wealth (excluding shareholdings), real interest rates, and the housing stock.[26]
The long-term equation for house prices is as follows:

$$\ln\left(p_{hu}^{*} / p_{cpi}\right) = 1.33 \ln\left(LDA / p_{cpi}\right) - 5.91\left(r_l - \overset{\circ}{p}_{cpi} . fp\right) + 0.71 \ln\left(W_{nof}^{g} / p_{cpi}\right) - 1.44 \ln\left(wv\right) \qquad (4.14)$$

where:

p_{hu}	price of residential building
p_{hu}^{*}	long-term level of the price of residential buildings
p_{cpi}	consumerprice index
LDA	disposable labourincome
r_l	long-term interest rate
W_{nof}^{g}	nominal net other financial wealth of households
wv	volume total dwelling stock (average)

The short-term equation in principle includes the same variables as the long-term equation. However, with regard to real interest rates, separate parameters have been estimated for nominal interest rates and the deflator. The reason for this is the assumption that potential buyers will respond differently to a change in nominal interest rates than to a change in actual or projected inflation.

Empirical research has also prompted the introduction of a non-linear error correction mechanism. Here, a downward adjustment of actual house prices to long-term value takes longer than an upward adjustment. This is because sellers can raise the asking price more quickly when actual house prices stayed below their long-term values in the previous period than they will reduce the asking price when actual prices were above their long-term values. And potential buyers are more likely to offer slightly more when they believe that long-term house values were above the actual values in the previous period, speculating that house prices will rise or rise further in the coming period. Hence there is downward price rigidity.

[25] See Verbruggen, Kranendonk, Van Leuvensteijn and Toet (2005) for a detailed description of the new house price equation.

[26] This may lead to a situation where house prices develop differently from the average price level. Over the long term this is unsustainable, however. To ensure that in the calculation of stable growth paths house prices move in line with the average price level, the estimated house price equation can be replaced with an equation in which over the long term house prices move in line with the (cost) prices of newly-built homes. See also appendix C.

The current specification of the short-term house price equation is as follows:

$$\left(\frac{\overset{\circ}{p}_{hu}}{P_{cpi}}/\right) = 1.16\, g_6 \left(\overset{\circ}{LDA} - \overset{\circ}{p}_{cpi}\right) - 4.62\, g_{23}\, \Delta(r_l) + 1.54 \left(\Delta \overset{\circ}{p}_{cpi} \,.\, fp\right) - 1.12\, \overset{\circ}{wv}$$

$$+\ 0.14\, dum_2\ - \frac{0.48}{fp} \ln\left(\frac{P_{hu}}{P^*_{hu}}\right)_{-1} + \frac{0.38}{fp} \left(bd * \ln\left(\frac{P_{hu}}{P^*_{hu}}\right)\right)_{-1} \qquad (4.15)$$

where:

p^*_{hu}	long-term level of the price of residential buildings
P_{cpi}	consumerprice index
LDA	disposable labourincome
r_l	long-term interest rate
W^g_{nof}	nominal net other financial wealth of households
wv	volume total dwelling stock (average)
dum_2	dummy for the year 2000 (2000=1; other years 0)
bd	binaire dummy; if $\ln\left(\frac{P_{hu}}{P^*_{hu}}\right) > 0$ then $bd = 1$; else $bd = 0$

According to this equation, the error correction parameter is 0.48 in case of a positive residue between the actual and long-term value of house prices, but only 0.10 in case of a negative residue.

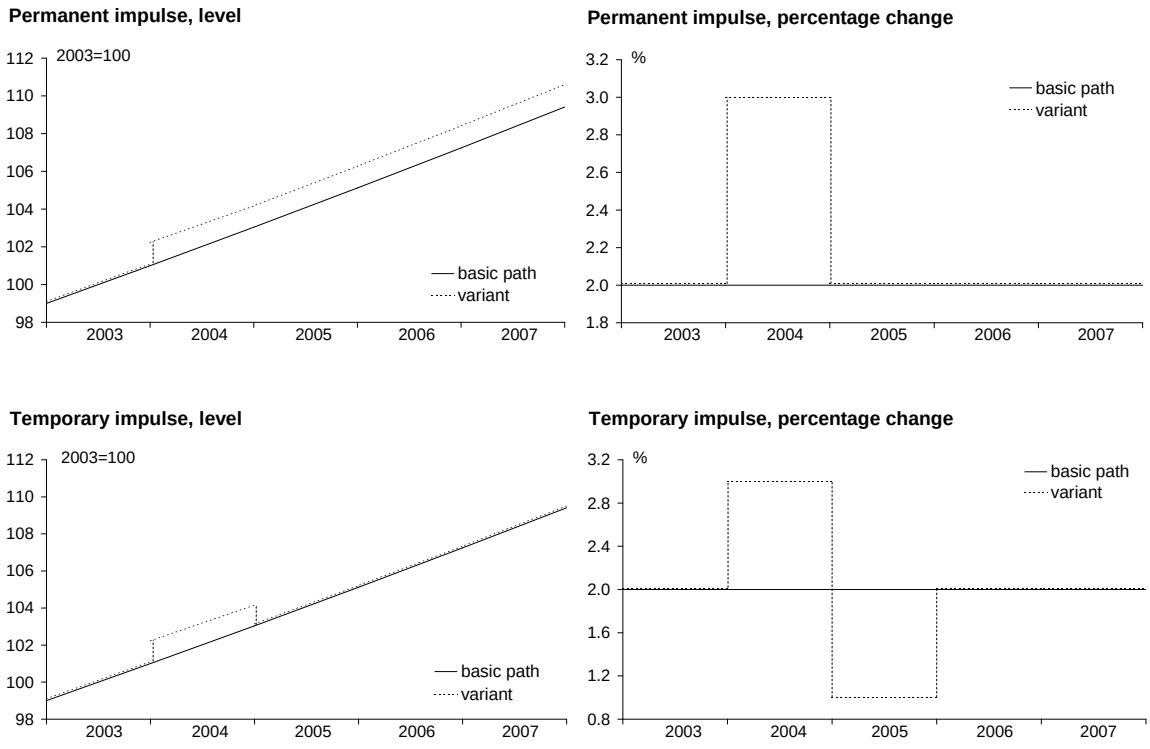
5 Standard variants

5.1 Introduction

To illustrate how SAFFIER operates, this chapter presents several standard variants and standard scenarios. A box outlines the differences between a variant and a scenario. It should be stressed that what follows is based on the operation of the model's current standard version. If the model is used to calculate particular uncertainties for the CPB's *Central Economic Plan* and *Macro Economic Outlook* or specific policy variants, the impulse and/or the model version used can be adjusted to the current situation.[27]

In all variants, we have applied a one-off impulse to the absolute or relative change of one or more exogenous or autonomous variables. This involves a permanent shock in the levels of the variables in question. Figure 5.1 show the difference between a permanent and a one-off level shock.

Figure 5.1 Difference between a permanent and a one-off level shock



[27] By way of illustration, the following example. In determining the consequences of an upward oil price shock on the economy, the standard model assumes that the oil price will rise on 1 January of the first year and that the resulting higher inflation will have a knock-on effect on pay rates over the short term. In the specific case of an oil price shock set out in the CPB's *Central Economic Plan* or the *Macro Economic Outlook*, for instance, it is possible to simulate the effects of a higher oil price from 1 April or 1 October. It is also possible to factor in that the higher inflation will not have a knock-on effect on wage rates over the short term, namely if many of the collective labour agreements (CAOs) for the current and coming year have already been concluded.

The top two diagrams relate to a permanent impulse. At the top left, one can see that the level of the variable in question in that case will work out permanently higher than in the basic path. In percentage changes there is a one-off shock, after which the changes are the same again as those in the basic path. The bottom two diagrams relate to a temporary impulse. In this case, the level of the variable in question returns to the basic path in the year after the impulse. To achieve this, a negative shock will have to be applied in the year after the positive shock.[28]
We have calculated the outcomes after 1-2 years with the quarterly version of the model, and the outcomes for the medium term (4-8 years) with the annual version. In section 5.2 onwards, the following standard variants and standard scenarios are presented and discussed briefly:

1. An increase in the relevant world trade by 1%;
2. An increase in Dutch long-term interest rates by 1 percentage point;
3. An increase in the euro exchange rate by 5% (variant and scenario);
4. An increase in the oil price by 20% (variant and scenario);
5. An autonomous wage impulse of 1%;
6. A reduction in the minimum wage and linked benefits by 5%;
7. A reduction in payroll and income tax by 1% of GDP;
8. An increase in the general VAT rate by 1% of GDP;
9. An increase in the public sector's expenditures by 1% of GDP;
10. An autonomous increase in the labour supply by 1%;
11. An increase in share prices by 20%;
12. An autonomous increase in average house prices by 10%.

The variant tables are expressed in "cumulative deviations from the central projection". A box in the world trade variant (section 5.2) explains what is meant by this and how the variant tables should be interpreted.

[28] Regardless of the sign (plus or minus), the magnitude of the positive or negative shock is identical if the shock is expressed in absolute changes. If the shock is in percentage changes, the starting levels in the first and second years will be different.

Variants versus scenarios

In a full or partial variant an impulse is given to a single exogenous variable or autonomous term, while in a scenario an alternative picture is given (in the Netherlands and/or internationally). In this document the scenarios relate to changes in the euro exchange rate and the oil price. These changes never occur in a vacuum, but invariably flow from changes in the general international situation. Thus an appreciation of the euro will have implications not only for price trends, but also for relevant world trade and international interest rate levels. The same is true *mutatis mutandis* for changes in the oil price.

Preparing such international scenarios in effect involves thinking through why the variable in question is changing, and this is then translated consistently into various other international variables. The determination of the knock-on effects on other international variables is done on the basis of outcomes calculated with the OECD's multinational model INTERLINK.[a] All this implies that if a change in the euro exchange rate or the oil price is attributed to other factors, this may have implications for the composition of the impulse and hence for the model outcomes. For instance, if a higher oil price is caused by an increase in world demand for oil sparked by strong economic growth, this will have different implications for the international and the Dutch economies than if the higher oil price is caused by a reduced supply owing to terrorist attacks or industrial disputes in the oil-producing countries. From this perspective the presented scenarios are less "standard" than the variants.

Because the INTERLINK-based impulses of the euro exchange rate and oil price simulations are only available for the first five years, the variants and scenarios in question are also only presented for those years.

[a] See Dalsgaard, André and Richardson (2001).

Balanced budget

We have calculated the simulations on the assumption of constant nominal interest rate levels and unchanged tax rates and social security contribution premiums. Most variants have an impact on the public sector's EMU balance, however. This is plausible enough for short-term analyses, since government policy is not aimed at stabilising the EMU balance year after year. But for analyses over the longer term this is less plausible, and a deterioration of the EMU balance (as a percentage of GDP) will sooner or later prompt the government to take measures to raise revenues or cut spending. In case of an improvement in the EMU balance, the converse will apply.

To show the characteristics of the model in case a "closure rule" is imposed on the public sector, we also present the outcomes over the medium term under the assumption of a balanced budget. But this is done only when the "open budget" variants show a noticeable effect on the EMU balance over the medium term. In the model version used to calculate the balanced budget outcomes, payroll and income tax rates have been endogenised and it is assumed that the government will set these rates to ensure that the EMU balance (as a percentage of GDP) will not change.[29]

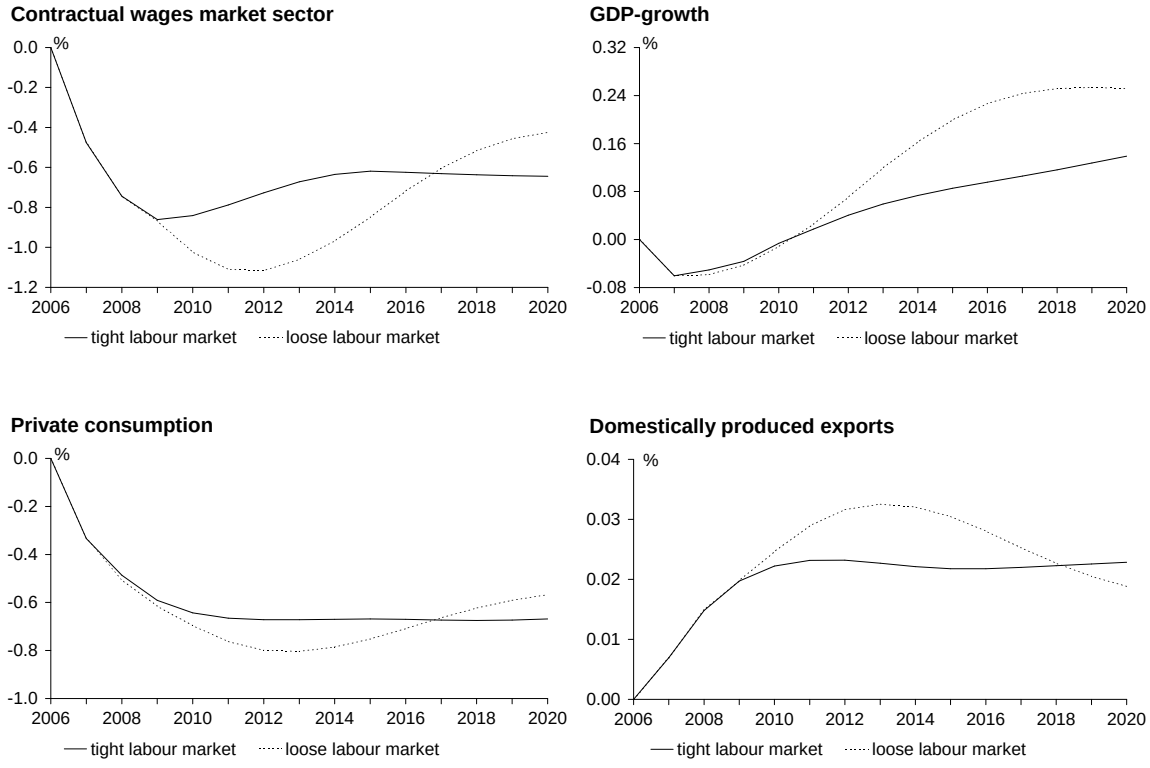
[29] SAFFIER also contains the option of calculating with an alternative closure rule, under which not only payroll and income tax ensures a balanced budget, but all taxes. However, it is more common to use only payroll and income tax in this context.

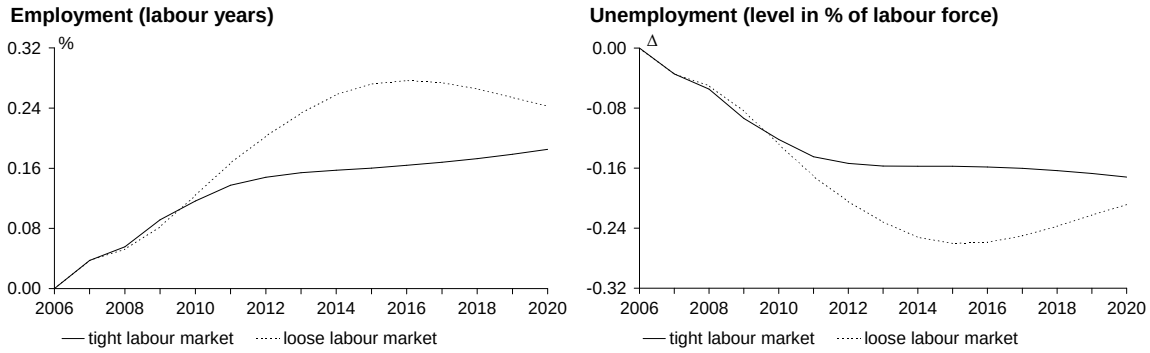
Model linearity

As with SAFE and JADE, the precise outcomes in SAFFIER depend on the underlying central path. But with the addition of a number of non-linearities in the equations for wages and house prices, the path dependency of the new model has increased somewhat. By way of illustration, we have calculated the implications of a reduction in the minimum wage and linked benefit payments by 5% under conditions of a loose and a tight labour market. In this variant, the non-linearity of SAFFIER is revealed rather strongly, because the elasticity of the replacement rate in the wage equation depends on the tension on the labour market (see section 4.1.1).

In the central path with which the standard variants are calculated, 4½% of the labour force is unemployed. To illustrate the non-linear operation of the model, we have calculated two alternative central paths: one for a loose labour market situation, with an unemployment rate of 6% in 2007; and one for a tight labour market situation, with an unemployment rate of 3% in 2007. Because a loose or tight situation on the labour market cannot continue indefinitely, it is assumed that in both paths the unemployment rate will return to the "normal" level of 4½% gradually, that is, after six years. For 2006 and 2007, both model versions are based on the projection in the CPB's *Central Economic Plan 2006*. The tension on the labour market will thus differ in both alternative central paths only in the period between 2008 and 2013. That is why the impulse has been given in 2008.

Figure 5.2 **Effect of a reduction in the minimum wage and linked benefit payments by 5% in temporarily tight and loose labour market conditions (with 3% and 6% unemployment respectively)**





One can deduce from figure 5.2 that a reduction in the minimum wage has a larger (negative) effect on market sector contractual pay rates when the labour market is loose than when it is tight. The difference is greatest after five years or so, amounting to around 0.2 percentage points. Because of the lower contractual wage increases, private consumption growth also comes out somewhat lower in a loose labour market. Against this, however, the more moderate labour cost trends in a loose labour market provide an additional stimulus to exports, because the more favourable price competitive position gives a boost to exports. In the first four years the expenditure effect via private consumption will dominate, so that GDP growth works out marginally lower. Subsequently the effect of the improved price competitiveness will dominate, so that output and employment will work out somewhat higher on balance. Incidentally, over the longer term the differences remain rather limited: the additional growth in output and employment is less than 0.1 percentage point.

Because the difference between the two alternative paths disappears over time, both lines in figure 5.2 will converge over the long term towards the long-term effect of the reduction in the minimum wage. For a more detailed description of the economic implications of this variant, see section 5.7.

Starting point: central path and regime dummies

We calculated the standard variants below with the model version used in the CPB's *Central Economic Plan 2006*, which was published in the spring of 2006. This means that the central path for 2006 and 2007 also coincides with that projection. For the subsequent years, a *technical* path has been made, in which the relevant variables increase by 2% per year in both volume and price terms. As figure 5.2 shows, the outcomes depend on the level of unemployment. The variants presented here are based on "normal" labour market conditions (i.e. neither tight nor loose), under which in the central path unemployment amounts to 4½% of the labour force after 2007. This percentage is broadly in line with the average unemployment rate between 1998 and 2004.

The model outcomes are also influenced by the value of what are called "regime dummies", because these switch on or off certain linking and other mechanisms in the model. Appendix C

gives an overview of all dummies, which can be divided into two categories. Some dummies make it possible to take account of alternative institutions in a relatively straightforward way, for instance with regard to the linking or otherwise of public sector wage rates and benefit payments to wages trends in the market sector. Other dummies have been built into SAFFIER to ensure that the model converges towards a stable growth path over the long term. That requires, for instance, the exclusion of the progression factor in taxes, the exclusion of trend terms in export equations, and the determination of house prices on the basis of construction costs rather than demand factors.[30]

The standard variants describe the effects over the short term (1-2 years) and over the medium term (4-8 years). The short-term effects have been calculated with the quarterly version of the model, and the medium-term effects with the annual version. For calculations with these time horizons, the dummies have been chosen to reflect the current progression factors and institutional linking mechanisms.

Programme effects

Finally, it should be noted that in determining the implications of public spending, we have taken account only of the expenditure effects. We have abstracted from what are called the "programme effects" of, for instance, additional outlays on education, infrastructure and public safety, because not enough is known of these at the moment. This does seriously constrain the usefulness of variants which involve increases in public spending, however. Since such programme effects tend to occur above all over the longer term, this limitation applies in particular for outcomes over a period of more than eight years.

5.2 An increase in relevant world trade by 1%

The first variant demonstrates the effects of a world trade impulse of 1%. That is to say, an increase in relevant world trade which works out 1 percentage point higher in the first year (2007) than in the central path. This variant has a partial character, which means that all other foreign variables, such as exchange rates, interest rate levels, competitor countries' export prices and import prices, are assumed to be unchanged.[31] However, the impulse does contain a 1.8% increase in the international sales of semiconductors, which is the relevant scale variable for re-exports (see section 4.3).

[30] For exercises over the short and medium term, we have used the new equation for house prices, in which the real interest rate is one of the explanatory variables (see appendix A). In variants in which inflation fluctuates sharply over the short term – as in the case of an increase in value added tax, the euro exchange rate or the oil price – the deflator of nominal interest rates in the house price equation, which is a proxy for inflation expectations, gives excessive effects on house price trends. In these variants this inflation effect has therefore been switched off, in anticipation of the results of future research.

[31] It is assumed that in this variant the investment ratio of manufacturing industry in other countries will move in line with that in the Netherlands, so that the relative investment ratio will have no impact on short-term trends in domestically-produced exports.

How should the variant tables be interpreted?

For all variables, the outcomes mentioned below are expressed in cumulative deviations from the central projection. What does this mean? This becomes clear when one realises how the variant outcomes are calculated. When calculating a variant with SAFFIER, an alternative path is made in level terms for all variables.

The discrepancies between the level in the alternative path and the central path are generally expressed as a percentage of the level in the central path. This happens with variables where the main interest is in trends or developments, such as GDP growth, the expenditure categories and the consumer price index. For these variables the variant table shows "%" after their description. Thus the table for the world trade variant shows the figure "0.5" under production volume in the market sector in the second year. This means that in the case of the world trade variant in question, the *level* of market sector output in 2008 is 0.5% higher than in the central path. Since the table on the world trade variant already shows market sector output coming out 0.4% higher in the first year, the world trade impulse has a positive effect on output *growth* in the second year of 0.1 percentage point. Illustrative in this regard is also the trend in domestically-produced exports. In the second year the volume *level* of this export category is 0.6% higher than in the central path. But in the first year the *level* is 0.8% higher, which implies that while the world trade impulse boosts the growth of domestically-produced exports by 0.8 percentage point in the first year compared to the central path, it actually depresses it by 0.2 percentage points in the second year.

However, for a limited number of variables, the interest is not so much on the effect on growth as on the effect on the level. In most cases these are variables which express ratios, such as those as a percentage of GDP or the labour force. For these variables, a Δ has been placed next to the description in the variant table. If the table for the world trade variant shows a figure of –0.2 under "unemployment (in % of labour force)" in the fourth year (i.e. 2010), this means that the unemployment rate in 2010 will be 0.2 percentage points lower than in the central path. On the assumption that the unemployment rate in the central path is 4.5% in 2010, this means that the percentage in the world trade variant in question would be 4.3%.

In this variant, the increased demand on the world market relevant for Dutch businesses – the Dutch export market, in other words – will give a boost to exports and hence also to market sector output. In the first year the percentage increase in non-energy exports will be identical to that of world trade as whole, because over the short term the downward effects are compensated by the upward effects. The downward effects are connected with what is known as the "home pressure of demand" effect and the deterioration of price competitiveness, both of which are caused by the increase in the capacity utilisation rate. The upward effects are connected with the composition of the Dutch export mix, which is such that world demand for "Made in Holland" products increases relatively quickly and sharply when the world economy is in an upswing.

Furthermore, an increase in the international semiconductor sales will generate considerable additional re-exports. Since it takes some time before these semiconductors have been incorporated into products (such as computers, mobile telephones and televisions), the additional increase in re-exports occurs with a time lag. In contrast with domestically-produced exports, re-exports are not (or only barely) adversely affected by the deteriorating price competitiveness. This is one of the reasons why, after eight years, re-exports will be expanding four times as much as "Made in Holland" exports.

Tabel 5.1 Effects of a 1% impuls in relevant world trade

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	0.3	0.3	0.4	0.4	0.7
Production market sector	%	0.4	0.5	0.6	0.5	0.9
Private consumption	%	0.1	0.2	0.3	0.6	1.4
Gross fixed investment, private non residential	%	0.5	1.0	0.9	0.4	1.1
Private residential investment	%	0.0	0.1	0.3	0.8	1.9
Exports of goods (non-energy)	%	1.0	1.0	1.1	1.0	1.1
of which domestically produced	%	0.8	0.6	0.7	0.4	0.6
re-exports	%	1.1	1.4	1.5	1.6	1.6
Imports of goods	%	0.8	1.0	1.0	1.1	1.3
Prices and wages						
Compensation per employee market sector	%	0.3	0.3	0.5	1.1	0.8
Contractual wages market sector	%	0.3	0.3	0.5	1.0	0.8
Consumer price index (CPI)	%	0.1	0.1	0.1	0.3	0.2
Exports price goods (excluding energy)	%	0.1	0.1	0.1	0.2	0.1
Price GDP	%	0.1	0.2	0.2	0.5	0.4
Price of gross value added market sector	%	0.1	0.2	0.1	0.5	0.3
Price competitiveness	%	− 0.1	− 0.2	− 0.1	− 0.3	− 0.2
Labour market						
Employment market sector (labour years)	%	0.1	0.3	0.3	0.2	0.5
Labour force (persons)	%	0.0	0.0	0.1	0.1	0.3
Unemployment rate (level in % labour force)	Δ	− 0.1	− 0.2	− 0.2	− 0.1	− 0.3
Miscellaneous items						
Labour productivity market sector	%	0.4	0.1	0.1	0.2	0.2
Individual savings rate (in % of disp. income)	Δ	0.1	0.1	0.0	− 0.1	− 0.1
Capacity utilisation rate market sector	Δ	0.4	0.2	0.2	0.2	0.3
Labour income share in enterprise income (level in %)	Δ	− 0.2	0.0	0.2	0.2	0.2
Net national income (volume)	%	0.4	0.5	0.5	0.6	0.9
General government financial balance (level in % GDP)	Δ	0.1	0.2	0.2	0.3	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.0	0.0	0.0	0.1	− 0.3

% = cumulative relative difference.

Δ = cumulative absolute difference.

Private consumption and above all business investment will also increase already in the first year. Consumption works out higher because real wages and hence real disposable incomes will rise, owing to an increase in labour productivity and a decline in unemployment. Investment will increase because output is higher and profitability is improving. Over the short term, GDP growth will increase cumulatively by around 0.3 percentage points. The additional consumption, investment and exports will be accompanied by additional final and intermediary imports of goods and services, so that the effect on economic growth will remain within bounds.

The higher output will result in an increase in employment. But because of the delay with which businesses recruit new staff, employment growth will still be modest in the first year. Employment growth will pick up in the second year in particular, which will have a positive impact on consumption growth.

Investment activity is given a boost in the early years from the increased production, but against this there is the unfavourable effect of lower profitability after the second year, as expressed in a higher labour share of enterprise income.

The additional economic growth leads to some tension on the labour and product markets, which is reflected in a lower unemployment rate and a higher capacity utilisation rate. Over the short term the consequent inflationary effects will be very limited, not least because the increase in labour productivity will feed into higher wages with a time lag. After some time the inflationary effects will become increasingly pronounced, however, and a wage/price spiral will develop. The result is that the Netherlands' price competitiveness – defined here as the price of relevant world trade minus the price of domestically-produced manufacturing exports – will deteriorate, so that domestically-produced exports will also come under some pressure.

The higher production growth will lead to an improvement in the EMU balance. This is above all due to the higher tax revenues and lower social security payment volumes. Because of the improvement in the EMU balance in the early years, the public debt will develop very favourably, which yields a permanent benefit in the form of lower interest payments. If this windfall ends up with consumers, through lower payroll and income tax rates, then real disposable incomes and hence private consumption and residential investment will receive a further boost. The same applies for the labour supply. All in all, after eight years GDP will be growing nearly twice as much in the balanced budget variant as in the standard variant with an open budget.

5.3 An increase in Dutch long-term interest rates by 1 percentage point

SAFFIER assumes that Dutch long-term interest rates are decided in effect by the European Central Bank (ECB) in Frankfurt. The impulse of this variant therefore consists of an increase in foreign long rates by 1 percentage point. But this is a partial variant, in which we have

abstracted any effects on prices of competitors and suppliers abroad as well as effects on world trade.[32] The outcomes in table 5.2 can therefore best be interpreted as the implications of higher interest rates in the Netherlands, without rates being raised in other countries. In the current economic context this is not very realistic, so that the main purpose of this variant is to gain an understanding of how the model operates when interest rate change.

The higher interest rates will depress domestic expenditure, because borrowing becomes more expensive. This applies to both consumption and investment. The higher interest rates will also reduce the scope for financing home ownership. This has a depressing effect on average house prices, so that a lower housing wealth will depress private consumption further. From the second year onwards market sector output will therefore work out considerably lower, which with a time lag will also have an adverse effect on employment.

Over the short term the effects on inflation will remain exceedingly limited. The higher costs of capital will be offset by easing tension on the goods market, which will temper inflation to some extent. Over the medium term, inflation will rise and the price competitiveness of Dutch producers (both on the domestic and the foreign markets) will come under pressure. Consequently, domestically-produced exports will suffer, while there is also an upward effect on import intensity. In reality, however, this effect will not be felt in full, because if interest rates rise, the costs of capital for euro zone competitors will also rise. A box analyses the effects if there is no deterioration in price competitiveness. In that case, “Made in Holland” exports will not suffer, and the fall in GDP growth will amount to only a fraction of that in the standard variant.

The implications of higher interest rates for the public finances are unfavourable, because of the additional interest payments by the government, the additional public spending to cover higher unemployment benefit volumes, and the reduction in tax revenues as the economy performs less well. If (in the balanced budget variant) the government decides to compensate the deterioration of the public finances by raising payroll and income tax rates, then the economic effects will prove even more unfavourable. Because of the consequent loss of purchasing power, private consumption will decline even further. The lower net real wages will depress the labour supply, which will put economic growth under further pressure.

[32] It is assumed that in this variant the investment ratio of manufacturing industry in other countries will move in line with that in the Netherlands, so that the relative investment ratio will have no impact on short-term trends in domestically-produced exports.

Tabel 5.2 Effects of a 1 percentage-point higher Dutch long-interest rates

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	− 0.2	− 0.6	− 1.2	− 2.2	− 3.7
Production market sector	%	− 0.2	− 0.7	− 1.5	− 3.0	− 4.8
Private consumption	%	− 0.5	− 1.0	− 1.3	− 1.8	− 5.4
Gross fixed investment. private non residential	%	− 1.0	− 2.7	− 4.5	− 4.7	− 8.1
Private residential investment	%	− 0.8	− 3.5	− 4.6	− 5.6	− 9.9
Exports of goods (non-energy)	%	0.0	0.0	− 0.7	− 2.1	− 2.6
of which domestically produced	%	0.1	0.1	− 1.3	− 4.3	− 5.1
re-exports	%	0.0	0.0	− 0.1	− 0.2	− 0.2
Imports of goods	%	− 0.2	− 0.6	− 0.9	− 1.3	− 2.4
Prices and wages						
Compensation per employee market sector	%	− 0.2	0.1	1.2	0.8	2.1
Contractual wages market sector	%	− 0.1	0.2	1.3	1.1	2.5
Consumer price index (CPI)	%	0.0	0.3	1.4	2.4	2.9
Exports price goods (excluding energy)	%	0.0	0.1	0.8	1.2	1.6
Price GDP	%	0.0	0.4	2.0	3.1	4.0
Price of gross value added market sector	%	0.1	0.5	2.5	4.0	5.1
Price competitiveness	%	0.0	− 0.2	− 1.3	− 2.1	− 2.7
Labour market						
Employment market sector (labour years)	%	0.1	− 0.2	− 0.8	− 1.4	− 2.6
Labour force (persons)	%	0.0	0.0	− 0.1	− 0.3	− 0.9
Unemployment rate (level in % labour force)	Δ	− 0.1	0.1	0.6	1.1	1.6
Miscellaneous items						
Labour productivity market sector	%	− 0.4	− 0.5	− 0.4	− 1.2	− 1.3
Individual savings rate (in % of disp. income)	Δ	0.5	0.6	0.3	0.2	− 0.3
Capacity utilisation rate market sector	Δ	− 0.3	− 0.5	− 0.5	− 1.3	− 1.7
Labour income share in enterprise income (level in %)	Δ	0.1	0.0	− 0.8	− 1.7	− 1.5
Net national income (volume)	%	− 0.2	− 0.5	− 0.4	− 1.0	− 2.2
General government financial balance (level in % GDP)	Δ	− 0.1	− 0.4	− 0.9	− 1.6	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.0	− 0.1	− 0.3	− 0.4	1.7

% = cumulative relative difference.

Δ = cumulative absolute difference.

A rise in long-term interest rates by 1 percentage point without a deterioration in price competitiveness

In the standard variant, long-term interest rates rise only in the Netherlands, so that the price competitiveness of Dutch producers will deteriorate in comparison with foreign competitors. However, it is likely that if interest rates rise in the Netherlands, they will also rise in many other countries. This means that the unfavourable effects of higher interest rates are overestimated in the standard variant. By way of illustration, we have carried out a simulation of the implications of higher interest rates if there were no deterioration in price competitiveness. This was done by switching off the relative price terms in all export and import equations. What this model intervention boils down to is that the effect of higher interest rates on the selling prices of *all* foreign competitors is assumed to be identical to the effect in the Netherlands. If the higher interest rates are limited to the euro zone, or if foreign competitors produce less capital-intensively, these outcomes will underestimate the unfavourable economic effects, however. It should be noted that this adjusted variant is not a scenario, because, for instance, no account has been taken of the adverse implications for world trade. From that perspective the outcomes below also underestimate the unfavourable volume effects.

In this case the volume effects will be appreciably less favourable than in the standard variant. Unemployment will increase by less, so that the downward pressure on contractual wages will also ease. This will generate a stronger wage/price spiral than in the standard variant.

Effects of a 1 percentage point higher long-term interest rate without a deterioration in price competitiveness

Year		2007	2008	2010	2014
Effect after year t		1	2	4	8
		cumulative deviations from central projection			
Volumes					
Gross domestic product (GDP)	%	– 0.2	– 0.5	– 0.7	– 0.3
Private consumption	%	– 0.5	– 0.8	– 1.0	– 0.3
Gross fixed investment. private non residential	%	– 0.9	– 2.2	– 3.0	0.2
Private residential investment	%	– 0.8	– 3.5	– 4.5	– 4.2
Exports of goods (non-energy)	%	0.0	0.1	– 0.1	– 0.1
of which domestically produced	%	0.1	0.2	0.0	0.0
Imports of goods	%	– 0.2	– 0.5	– 0.6	– 0.2
Prices and wages					
Contractual wages market sector	%	0.0	0.3	1.7	3.3
Consumer price index (CPI)	%	0.1	0.3	1.6	3.0
Exports price goods (excluding energy)	%	0.0	0.2	0.9	1.5
Price competitiveness	%	-	-	-	-
Miscellaneous items	%				
Employment market sector (labour years)	%	0.0	– 0.2	– 0.5	0.0
Unemployment rate (level in % labour force)	Δ	0.0	0.2	0.4	0.0
Labour income share in enterprise income (level in %)	Δ	0.1	– 0.1	– 1.0	– 1.2
General government financial balance (level in % GDP)	Δ	– 0.1	– 0.4	– 0.7	– 0.4

5.4 An increase in the euro exchange rate by 5%

To illustrate the sensitivity of the Dutch economy to the euro exchange rate, we have calculated a variant and a scenario which assume that the euro will appreciate against all other currencies by 5% more than in the central path from the start of 2007. The central path assumes that the US dollar will trade at 1.20 against the euro. The alternative path calculated here is thus based on a euro exchange rate of USD 1.26.

Since the euro exchange rate itself is not an exogenous variable in SAFFIER, the euro appreciation must be translated into exogenous variables which are included in the model. In the first place, these are all Dutch import prices (including the crude oil price) and competitor countries' export prices, which will drop in the variant at different rates. The magnitude of the various price impulses depends on the extent to which the imported goods and services and those of the Netherlands' competitors originate in non-euro countries or are traded in foreign currencies (mostly dollars). Since the dollar is more important for the import of raw materials and semimanufactures, for instance, than for the import of capital goods, the negative price impulse (in euros) for the former category will be relatively large. The price impulses are based on a euro exchange rate variant which has been calculated with the OECD's multi-country model INTERLINK. Since these impulses are only available for the first five years, only the first five years have been simulated with SAFFIER.

It is likely that the higher euro exchange rate will also have implications for relevant world trade and interest rates. However, we have abstracted from this in the calculation of the partial variant (see section 5.4.1), while we have included the projected implications for world trade and interest rates in the calculation of the scenario (see section 5.4.2).[33] For the volume effects of an exchange rate variant, the inclusion or otherwise of the effect on interest rates is of decisive importance.

5.4.1 Partial variant

The deterioration of price competitiveness leads first and foremost to a deterioration in the export performance. Since domestically-produced exports are more price-sensitive than re-exports, the negative effects of the deterioration in the competitive position will be felt particularly among domestically-produced exports. At the same time, private consumption will increase somewhat, because consumer prices will fall slightly faster than contractual wage rates in the first instance. On balance, GDP growth will decline by a cumulative ¼ percentage point in the first two years. The euro appreciation will have virtually no effect on investment, because

[33] It is assumed that in both the partial variant and the scenario the investment ratio of manufacturing industry in other countries will move in line with that in the Netherlands, so that the relative investment ratio will have no impact on short-term trends in domestically-produced exports.

Tabel 5.3 Effects of a partial variant with 5% increase of the euro exchange rate

						Balanced Budget
Year		2007	2008	2010	2011	2011
Effect after year t		1	2	4	5	5
		cumulative deviations from central projection				
International						
Relevant world trade volume	%	0.0	0.0	0.0	0.0	0.0
Export price goods (excl. energy) competitors	%	− 2.8	− 2.7	− 3.4	− 3.4	− 3.4
Export price services competitors	%	− 2.0	− 2.2	− 2.5	− 2.7	− 2.7
Import price goods	%	− 2.7	− 2.8	− 3.4	− 3.4	− 3.4
Import price crude oil	%	− 4.3	− 4.4	− 4.4	− 4.4	− 4.4
Import price services	%	− 2.0	− 2.2	− 2.5	− 2.7	− 2.7
Long-term interest rate	Δ	0.0	0.0	0.0	0.0	0.0
Volumes						
Gross domestic product (GDP)	%	− 0.2	− 0.3	− 0.4	− 0.5	− 0.7
Production market sector	%	− 0.4	− 0.5	− 0.7	− 0.8	− 1.1
Private consumption	%	0.2	0.4	0.4	0.3	− 0.4
Gross fixed investment. private non residential	%	0.0	− 0.2	− 0.3	− 0.4	− 1.0
Private residential investment	%	0.0	0.1	0.4	0.4	− 0.3
Exports of goods (non-energy)	%	− 0.8	− 0.6	− 0.9	− 1.0	− 1.1
of which domestically produced	%	− 1.3	− 1.1	− 1.6	− 1.9	− 2.0
re-exports	%	− 0.2	− 0.2	− 0.2	− 0.2	− 0.2
Imports of goods	%	− 0.1	− 0.1	− 0.2	− 0.3	− 0.5
Prices and wages						
Compensation per employee market sector	%	− 0.6	− 1.3	− 1.5	− 1.8	− 1.6
Contractual wages market sector	%	− 0.5	− 1.3	− 1.4	− 1.7	− 1.5
Consumer price index (CPI)	%	− 0.7	− 1.4	− 1.8	− 1.9	− 1.9
Exports price goods (excluding energy)	%	− 1.7	− 2.2	− 2.5	− 2.7	− 2.6
Price GDP	%	− 0.2	− 1.1	− 1.3	− 1.5	− 1.4
Price of gross value added market sector	%	0.2	− 0.9	− 1.0	− 1.1	− 1.0
Price competitiveness	%	− 1.5	− 0.6	− 0.9	− 1.0	− 1.1
Labour market						
Employment market sector (labour years)	%	0.0	− 0.1	− 0.2	− 0.2	− 0.4
Labour force (persons)	%	0.0	0.0	0.0	0.0	− 0.1
Unemployment rate (level in % labour force)	Δ	0.0	0.1	0.2	0.2	0.3
Miscellaneous items						
Labour productivity market sector	%	− 0.4	− 0.3	− 0.4	− 0.5	− 0.5
Individual savings rate (in % of disp. income)	Δ	0.2	0.0	− 0.1	− 0.2	− 0.3
Capacity utilisation rate market sector	Δ	− 0.4	− 0.4	− 0.5	− 0.6	− 0.7
Labour income share in enterprise income (level in %)	Δ	− 0.4	− 0.1	− 0.1	− 0.2	− 0.1
Net national income (volume)	%	0.5	0.1	0.2	0.1	− 0.1
General government financial balance (level in % GDP)	Δ	− 0.1	− 0.2	− 0.3	− 0.3	0.0
Taxes and social security contributions (level in % GDP)	Δ	− 0.1	0.0	0.0	0.0	0.5

% = cumulative relative difference.

Δ = cumulative absolute difference.

the downward effect of lower output will be offset by the upward effect of higher profitability. With a time lag, the lower output growth will also be expressed in employment. Because of this delayed reaction, labour productivity growth in the market sector will fall over the short term.

Besides effects in the volume sphere, a more expensive euro will also have substantial effects in the nominal sphere. The lower import prices (in euros) will depress the prices of all expenditure categories. Because the production of consumer goods uses fewer imports than the production of exports, the depressing effect on consumer prices will be smaller than on export prices.

The revenues and expenditures of the public sector will also be affected by a more expensive euro. The main setback on the expenditure side arises from the higher volume of unemployment benefit payments. And the fall in employment will reduce tax revenues. Consequently the EMU balance will deteriorate by 0.1-0.2 percentage points of GDP over the short term.

After five years, the adjustment process of wages and prices will still not have been completed in this partial variant, and price competitiveness will still be deteriorating compared to the central path. Consequently, the volume of domestically-produced exports will work out lower over the medium term as well, with unfavourable implications for GDP growth.
Compared to the central path, the EMU balance will still be deteriorating after five years, owing to the lower economic growth and higher unemployment. If the government decides to compensate for this by raising payroll and income tax rates, then the effects in the volume sphere will be even more unfavourable.

5.4.2 Scenario

A more expensive euro will not only affect import and competitor prices in the Netherlands, it will also create a completely different international picture, as it were. After all, all suppliers in the euro zone will face deteriorating competitive positions. The higher euro exchange rate will act as a brake on economic activity across the euro zone, and will stimulate it outside the euro zone. Because Dutch exports are relatively strongly oriented towards the European hinterland, this will lead to lower Dutch relevant world trade. Moreover, it is likely that in case of a sustained euro appreciation, long-term interest rates would not remain unaffected. Thus the European Central Bank (ECB) might be tempted to cut money market rates, prompted by a fall in “imported inflation” and a deteriorating growth outlook for the euro zone. It is not easy to outline this alternative scenario. We decided to base the scenario on OECD exercises with the INTERLINK model.[34]

Specifically for the scenario calculated here, this means that the higher euro exchange rate will be accompanied by *temporarily* lower relevant world trade and lower international

[34] See Dalsgaard, André and Richardson (2001).

Tabel 5.4 Effects of a scenario with 5% increase of the euro exchange rate

Year		2007	2008	2010	2011
Effect after year t		1	2	4	5
		cumulative deviations from central projection			
International					
Relevant world trade volume	%	− 0.1	− 0.2	0.0	0.0
Export price goods (excl. energy) competitors	%	− 2.8	− 2.7	− 3.4	− 3.4
Export price services competitors	%	− 2.0	− 2.2	− 2.5	− 2.7
Import price goods	%	− 2.7	− 2.8	− 3.4	− 3.4
Import price crude oil	%	− 4.3	− 4.4	− 4.4	− 4.4
Import price services	%	− 2.0	− 2.2	− 2.5	− 2.7
Long-term interest rate	Δ	− 0.4	− 0.4	− 0.7	− 0.7
Volumes					
Gross domestic product (GDP)	%	− 0.2	− 0.1	− 0.1	0.0
Production market sector	%	− 0.4	− 0.3	− 0.3	− 0.2
Private consumption	%	0.4	0.8	1.0	1.1
Gross fixed investment. private non residential	%	0.3	0.7	1.4	1.6
Private residential investment	%	0.3	1.4	2.6	3.0
Exports of goods (non-energy)	%	− 0.9	− 0.8	− 0.9	− 0.9
of which domestically produced	%	− 1.5	− 1.2	− 1.6	− 1.6
re-exports	%	− 0.3	− 0.4	− 0.2	− 0.1
Imports of goods	%	− 0.1	− 0.1	0.2	0.2
Prices and wages					
Compensation per employee market sector	%	− 0.6	− 1.4	− 2.1	− 2.6
Contractual wages market sector	%	− 0.5	− 1.4	− 2.1	− 2.6
Consumer price index (CPI)	%	− 0.7	− 1.6	− 2.3	− 2.8
Exports price goods (excluding energy)	%	− 1.7	− 2.3	− 2.8	− 3.1
Price GDP	%	− 0.2	− 1.3	− 2.1	− 2.7
Price of gross value added market sector	%	0.1	− 1.1	− 2.0	− 2.6
Price competitiveness	%	− 1.5	− 0.5	− 0.4	− 0.2
Labour market					
Employment market sector (labour years)	%	− 0.1	− 0.1	0.0	0.1
Labour force (persons)	%	0.0	0.0	0.0	0.1
Unemployment rate (level in % labour force)	Δ	0.1	0.1	0.0	0.0
Miscellaneous items					
Labour productivity market sector	%	− 0.3	− 0.2	− 0.3	− 0.3
Individual savings rate (in % of disp. income)	Δ	0.1	− 0.3	− 0.4	− 0.5
Capacity utilisation rate market sector	Δ	− 0.3	− 0.3	− 0.5	− 0.4
Labour income share in enterprise income (level in %)	Δ	− 0.4	− 0.1	0.2	0.3
Net national income (volume)	%	0.5	0.2	0.2	0.1
General government financial balance (level in % GDP)	Δ	− 0.1	− 0.1	0.1	0.1
Taxes and social security contributions (level in % GDP)	Δ	0.0	0.0	0.2	0.2

% = cumulative relative difference.

Δ = cumulative absolute difference.

semiconductor sales on the one hand, and *permanently* lower long-term interest rates on the other hand. Because long-term rates will be lower not only in the Netherlands but also in the euro zone competitor countries, the positive implications of lower interest rates on price competitiveness have been switched off in the calculation of this scenario (see box in section 5.3). The top of table 5.4 lists the main impulses in the foreign exogenous variables.

Table 5.4 shows that the lower interest rates are of decisive importance. Because of the lower costs of capital, price competitiveness will recover more quickly than in the variant discussed above. What is more, the lower interest rates will also give a considerable boost to investment. Because of the positive effects arising from the lower interest rates, the downward effect on real GDP will not intensify after the first year, as in the partial variant, but will actually ease. After five years, GDP will be back at the starting level, and prices will have broadly converged towards those of the competitors, so that only a modest deterioration of price competitiveness will remain. The lower interest payments paid by the government will lead to a minimal improvement in the EMU balance over the medium term. But this is so small that no balanced budget variant has been calculated.

Model exercises by the OECD suggest that, compared to other euro zone countries, the Dutch economy is relatively sensitive over the short term to changes in the euro exchange rate. This applies not only to production volume, but also to inflation, so that the relatively large production effects will tend to ebb away more quickly as well. This is due above all to the relatively open character of the Dutch economy.[35]

5.5 An increase in the oil price by 20%

The crude oil price, measured in dollars per barrel, is a volatile entity. Under the influence of international political and other developments the oil price may surge or tumble over short periods of time. This variant is based on a permanent increase in the oil price by 20%. In the central path of the CPB's *Central Economic Plan 2006* (published in March 2006), the Brent crude oil price averages USD 55 per barrel in 2007. In this variant this translates into an increase in the oil price by USD 11 per barrel, to around USD 65. Such a sharp increase has negative economic consequences and upward effects on inflation worldwide. We have abstracted from this in the calculation of the partial variant (see section 5.5.1), while we have included the projected implications for world trade and interest rates in the calculation of the scenario (see section 5.5.2).[36]

[35] See also the CPB's *Central Economic Plan* 2002, section 3.3.5.

[36] It is assumed that in both the partial variant and the scenario the investment ratio of manufacturing industry in other countries will move in line with that in the Netherlands, so that the relative investment ratio will have no impact on short-term trends in domestically-produced exports.

5.5.1 Partial variant

Through higher cost prices, the higher oil price will have a knock-on effect on selling prices worldwide. Thus not only will the prices of imported energy products rise, but also the prices of other import components and of competitors' products. It is difficult to determine to what extent these foreign prices will change. In this variant the price impulses abroad have been based on oil price exercises using the OECD's multi-country model INTERLINK. Since these impulses are only available for the first five years, only the first five years have been simulated with SAFFIER. We have made an assumption that the higher global oil price will not affect the price competitiveness of Dutch exporters of goods and services. Or to put it differently, we have assumed that the higher oil price will affect the export prices of (doubly reweighted) competitor countries just as much in relative terms as those of the Netherlands.

Higher oil and import prices will push inflation upwards, through higher natural gas prices and higher costs. The price of gross added value in the market sector (hence without mining and quarrying sector) will fall in the first year, however, because the cost increases in the market sector triggered by the higher oil price cannot be passed on in higher selling prices. This will have a negative effect on the terms of trade, which will also lead to a situation where real national income will fall more than production. In the second year the cost increases can be passed on in selling prices after all, and this will have an upward effect on the price of added value. Not least owing to the erosion of the terms of trade, contractual wages will not increase by as much as inflation, so that private consumption will come under some pressure. Despite the lagging wage trends, the labour share in enterprise income in the market sector will increase considerably over the short term, which can also be attributed to the erosion of the terms of trade.

As stated, in this variant the higher oil price has no effect on the price competitiveness of Dutch exporters. Hence there are no implications for exports. With a time lag, employment will adjust to the lower production volume.

The effect of the higher oil price on the EMU balance is small over both the short and the medium term. This is because the higher unemployment benefit payment volumes and lower tax revenues will be offset by higher natural gas revenues arising from the higher domestic and international natural gas prices. The implications for the EMU balance are so small that we have refrained from calculating a balanced budget variant.

Tabel 5.5 Effects of a partial variant with a 20% increase of the oil price

Year		2007	2008	2010	2011
Effect after year t		1	2	4	5
		cumulative deviations from central projection			
International					
Relevant world trade volume	%	0.0	0.0	0.0	0.0
Import price goods	%	3.0	3.2	3.9	3.9
Import price crude oil	%	20.0	20.0	20.0	20.0
Import price services	%	0.6	0.8	1.3	1.5
Long-term interest rate	Δ	0.0	0.0	0.0	0.0
Volumes					
Gross domestic product (GDP)	%	− 0.1	− 0.2	− 0.2	− 0.3
Production market sector	%	− 0.1	− 0.1	− 0.3	− 0.4
Private consumption	%	− 0.3	− 0.7	− 0.9	− 1.1
Gross fixed investment. private non residential	%	− 0.5	− 1.1	− 1.4	− 1.6
Private residential investment	%	0.0	− 0.2	− 0.8	− 1.2
Exports of goods (non-energy)	%	0.0	− 0.1	− 0.1	− 0.1
of which domestically produced	%	0.0	0.0	− 0.1	− 0.1
re-exports	%	− 0.1	− 0.1	− 0.1	− 0.1
Imports of goods	%	− 0.2	− 0.4	− 0.6	− 0.6
Prices and wages					
Compensation per employee market sector	%	0.1	0.6	0.4	0.2
Contractual wages market sector	%	0.1	0.5	0.4	0.2
Consumer price index (CPI)	%	0.5	1.3	1.7	1.8
Exports price goods (excluding energy)	%	0.6	1.1	1.6	1.8
Price GDP	%	0.1	0.9	1.2	1.2
Price of gross value added market sector	%	− 0.6	0.0	0.2	0.2
Price competitiveness	%	-	-	-	-
Labour market					
Employment market sector (labour years)	%	0.0	− 0.2	− 0.4	− 0.4
Labour force (persons)	%	0.0	0.0	− 0.1	− 0.2
Unemployment rate (level in % labour force)	Δ	0.0	0.2	0.2	0.2
Miscellaneous items					
Labour productivity market sector	%	0.0	0.2	0.2	0.1
Individual savings rate (in % of disp. income)	Δ	− 0.3	− 0.2	0.0	0.0
Capacity utilisation rate market sector	Δ	0.0	0.1	0.2	0.1
Labour income share in enterprise income (level in %)	Δ	0.6	0.4	0.1	0.1
Net national income (volume)	%	− 0.7	− 0.5	− 0.6	− 0.8
General government financial balance (level in % GDP)	Δ	0.1	0.3	0.2	0.2
Taxes and social security contributions (level in % GDP)	Δ	0.1	0.0	− 0.2	− 0.2

% = cumulative relative difference.

Δ = cumulative absolute difference.

5.5.2 Scenario

A surge in the oil price will have negative consequences for economic growth and upward effects on inflation not only in the Netherlands but also in all oil-importing countries. Like the euro exchange scenario outlined above, the quantification of the oil price scenario is based on exercises by the OECD with the multi-country model INTERLINK. The basic assumption is that real interest rates as well as nominal dollar prices for all commodities excluding crude oil will not diverge from the central path.[37] Hence, contrary to what happened in the above variant, the export price of natural gas remains unchanged in this scenario, but the link between the domestic price for Dutch natural gas and the oil price is maintained. As in the partial variant, the assumption is that the higher global oil price will not affect the price competitiveness of Dutch goods and services exporters. The top of table 5.6 lists the main impulses in the foreign exogenous variables.

In this scenario, relevant world trade and international semiconductor sales will develop less favourably over the short term, while import prices and long-term interest rates will work out consistently higher than those in the central path. After the first year there is a positive effect on relevant world trade, on the assumption that the oil-exporting countries will start to spend their additional oil dollars after a short time lag. On the basis of past experiences, we have taken account of the fact that more of these additional oil dollars tend to be spent in Europe than in other countries or regions. That is why, after three years, relevant world trade will be temporarily higher in this scenario than in the central path. But after the third year relevant world trade will return to its original level.

From the outset the higher oil price will have a depressing effect on economic growth, but given the strength of the impulse, this effect is not disastrous. Over the medium term real GDP will work out around ½% lower than in the central path. All expenditure categories will develop less favourably. Private consumption will decline in the first instance because of the loss of purchasing power, a development reinforced in subsequent years by the less favourable trend in employment. Domestically-produced exports and re-exports will be depressed in the early years because of the less favourable international economic conditions. And investment will develop less favourably because of the lower production and profitability and the higher interest rates.

The higher oil price and import prices will push up inflation. However, contractual wage rates will decline in the first year, owing to the lower labour productivity growth and the lower price of gross added value in the market sector. The latter will happen because the higher production costs cannot be passed on fully in selling prices, not least because of previously-fixed contracts. But with a time lag the higher costs will lead to higher selling prices, and the price of gross added value will increase, which will then have an upward effect on contractual wage rates. After some time the increase in unemployment will have a downward effect on contractual wage rates, which will mark the end of the fall in employment. The positive effects

[37] See Dalsgaard, André and Richardson (2001).

Tabel 5.6 Effects of a scenario with a 20% increase of the oil price

						Balanced Budget
Year		2007	2008	2010	2011	2011
Effect after year t		1	2	4	5	5
		cumulative deviations from central projection				
International						
Relevant world trade volume	%	− 0.5	− 0.3	0.0	0.0	0.0
Import price goods	%	3.0	3.2	3.9	3.9	3.9
Import price crude oil	%	20.0	20.0	20.0	20.0	20.0
Import price services	%	0.6	0.8	1.3	1.5	1.5
Long-term interest rate	Δ	0.5	0.2	0.2	0.2	0.2
Volumes						
Gross domestic product (GDP)	%	− 0.3	− 0.5	− 0.4	− 0.5	− 0.8
Production market sector	%	− 0.4	− 0.6	− 0.5	− 0.6	− 0.9
Private consumption	%	− 0.6	− 1.2	− 1.3	− 1.5	− 2.2
Gross fixed investment. private non residential	%	− 1.3	− 2.7	− 2.0	− 1.9	− 2.4
Private residential investment	%	− 0.4	− 1.7	− 1.8	− 2.2	− 2.9
Exports of goods (non-energy)	%	− 0.5	− 0.3	0.1	− 0.1	0.0
of which domestically produced	%	− 0.4	− 0.1	0.0	− 0.1	− 0.1
re-exports	%	− 0.7	− 0.5	0.1	0.0	0.0
Imports of goods	%	− 0.7	− 1.0	− 0.5	− 0.7	− 0.9
Prices and wages						
Compensation per employee market sector	%	− 0.2	0.5	0.6	0.3	0.5
Contractual wages market sector	%	− 0.2	0.4	0.6	0.3	0.5
Consumer price index (CPI)	%	0.5	1.3	2.1	2.2	2.3
Exports price goods (excluding energy)	%	0.6	1.1	1.8	2.0	2.0
Price GDP	%	− 0.2	0.6	1.3	1.2	1.3
Price of gross value added market sector	%	− 0.7	0.0	0.8	0.6	0.8
Price competitiveness	%	-	-	-	-	-
Labour market						
Employment market sector (labour years)	%	0.0	− 0.5	− 0.5	− 0.5	− 0.7
Labour force (persons)	%	0.0	− 0.1	− 0.2	− 0.2	− 0.3
Unemployment rate (level in % labour force)	Δ	0.0	0.4	0.3	0.3	0.4
Miscellaneous items						
Labour productivity market sector	%	− 0.4	0.1	0.3	0.1	0.1
Individual savings rate (in % of disp. income)	Δ	− 0.2	− 0.1	0.1	0.1	0.0
Capacity utilisation rate market sector	Δ	− 0.4	0.0	0.2	0.1	0.0
Labour income share in enterprise income (level in %)	Δ	0.8	0.5	− 0.2	− 0.2	− 0.1
Net national income (volume)	%	− 1.2	− 1.3	− 1.1	− 1.4	− 1.6
General government financial balance (level in % GDP)	Δ	− 0.1	− 0.2	− 0.3	− 0.3	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.1	0.0	− 0.2	− 0.3	0.2

% = cumulative relative difference.

Δ = cumulative absolute difference.

of lower real labour costs will only occur after the fifth year, however, and hence they are not visible in table 5.6.

The EMU balance will deteriorate in this scenario. This is due to the less favourable economic performance, leading to lower tax revenues and higher unemployment benefit payment volumes, as well as higher interest payments by the government. If (in the balanced budget variant) the government decides that the EMU balance should not deteriorate and to that end raises payroll and income tax rates, then the volume effects will be even more unfavourable.

5.6 An autonomous wage impulse of 1%

Because wages are endogenous in SAFFIER, the simulation of a wage impulse has a different character than an exogenous shock, such as more world trade or lower tax rates. To analyse the implications of higher or lower wage rates, we have therefore given an impulse to the autonomous term in the wage equation. In the variant outlined here this is a permanent autonomous wage impulse of 1%. This pay increase is on top of the endogenous change in wage rates. In SAFFIER, the wage rate depend over the longer term on the wedge, the replacement rate, the unemployment rate, the price level and labour productivity (see section 4.1). A possible cause of such an additional wage increase may be an institutional change which permanently affects the negotiating positions of employers and employees. We are thinking here of, say, the introduction of greater flexibility in the labour market through a change in employment protection legislation or the statutory scope for temporary employment contracts.

In calculating the implications of the permanent wage impulse, we have assumed that contractual wages in the public sector will increase by as much as that in the market sector. The wage-related benefit payments, the minimum wage and civil service contractual wage rates are also assumed to increase by the same amount, because all linking and indexation mechanisms will apply. This implies that the wage-related benefits and the minimum wage will be raised, with a time lag, by the same percentage as average contractual wage levels.

The permanent wage impulse will result in higher prices, which in turn will push wages further upwards (it sets off a wage/price spiral, in other words). Private consumption will increase, thanks to the gain in purchasing power by employees and benefit recipients. Against this, domestically-produced exports will fall owing to a deterioration in price competitiveness and a decline in investment in response to falling profitability. In the first year, the positive expenditure effects will weigh just as heavily as the negative effects from lower exports, so that GDP growth and market sector output will not change compared to the central path. But employment will fall from the outset, because of the increase in real labour costs on the one hand and the lower profitability on the other hand. Consequently labour productivity in the market sector will work out fractionally higher in the early years.

Tabel 5.7 Effects of a 1% impulse in autonomous wages

Year		2007	2008	2010	2014
Effect after year t		1	2	4	8
		cumulative deviations from central projection			
Volumes					
Gross domestic product (GDP)	%	0.0	− 0.1	− 0.3	− 0.5
Production market sector	%	0.0	− 0.2	− 0.5	− 0.8
Private consumption	%	0.3	0.6	0.6	0.4
Gross fixed investment. private non residential	%	− 0.1	− 0.4	− 0.9	− 0.9
Private residential investment	%	0.0	0.2	0.5	0.3
Exports of goods (non-energy)	%	− 0.2	− 0.5	− 0.7	− 1.0
of which domestically produced	%	− 0.3	− 0.9	− 1.3	− 2.0
re-exports	%	0.0	− 0.1	− 0.1	0.0
Imports of goods	%	0.0	0.1	0.0	− 0.2
Prices and wages					
Compensation per employee market sector	%	1.5	2.1	1.9	1.2
Contractual wages market sector	%	1.5	2.0	1.9	1.2
Consumer price index (CPI)	%	0.3	0.7	0.8	0.7
Exports price goods (excluding energy)	%	0.2	0.4	0.4	0.4
Price GDP	%	0.6	1.2	1.3	1.1
Price of gross value added market sector	%	0.6	1.2	1.3	1.2
Price competitiveness	%	− 0.3	− 0.7	− 0.7	− 0.6
Labour market					
Employment market sector (labour years)	%	− 0.1	− 0.3	− 0.5	− 0.6
Labour force (persons)	%	0.0	0.0	0.0	0.0
Unemployment rate (level in % labour force)	Δ	0.1	0.2	0.4	0.5
Miscellaneous items					
Labour productivity market sector	%	0.1	0.1	0.1	0.0
Individual savings rate (in % of disp. income)	Δ	0.1	− 0.2	− 0.2	− 0.2
Capacity utilisation rate market sector	Δ	0.1	0.1	0.0	− 0.2
Labour income share in enterprise income (level in %)	Δ	0.6	0.5	0.3	0.0
Net national income (volume)	%	0.2	0.3	0.2	− 0.2
General government financial balance (level in % GDP)	Δ	0.1	0.1	0.0	− 0.2
Taxes and social security contributions (level in % GDP)	Δ	0.2	0.3	0.2	0.1

% = cumulative relative difference.

Δ = cumulative absolute difference.

In the second and third year, exports and investments will fall further, which will outweigh the positive effect through private consumption. Consequently, the implications of a permanent pay increase are on balance unfavourable for the market sector output after the first year. The same is true over the medium term, which can be attributed in particular to a greater unwillingness by trade unions to accept pay restraint (as simulated in this variant).

The effects of the pay increase on the EMU balance will be limited in the early years. In the first year the EMU balance will improve slightly, because the additional tax revenues (from payroll and income tax and value added tax) will outweigh the higher outlays on civil service pay and social security benefits. Over time, however, this will change, and the EMU balance will deteriorate slightly.

5.7 A reduction in the minimum wage and linked benefits by 5%

In this variant, the levels of the minimum wage and social security benefits are reduced autonomously by 5%. Such a measure will reduce the purchasing power of benefit recipients, which has a negative effect on private consumption. It will also reduce labour costs, because a reduction in benefit payments is tantamount to a reduction in the replacement rate. This will put contractual wages under pressure, because a reduction in the replacement rate implies a deterioration in workers' fallback positions in case of redundancy. The extent to which this happens depends on the tightness on the labour market, as illustrated in section 5.1. In the central path used here, unemployment averages 4½% of the labour force after 2007, which is broadly in line with the average between 1998 and 2004.

The induced moderation of contractual pay rates results in some loss of purchasing power among employees, albeit significantly less so than among benefit recipients. The lower purchasing power among employees will also depress consumption. Against this, the lower labour costs provide the conditions for an increase in domestically-produced exports. Production in the market sector will be marginally lower in the first year compared to the central path. Over the medium term, however, market sector output will increase somewhat. This is largely because the lower replacement rate will lead to an improvement in price competitiveness, which in turn will lead to more "Made in Holland" exports.

Over the short term, employment in the market sector will remain stable, because the reduction in real labour costs and the improvement in profitability will offset the lower output. Over the medium term, employment in the market sector will work out slightly higher, owing to the higher production volume.

Tabel 5.8 Effects of a 5% reduction in the minimum wage and linked benefits

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	− 0.1	− 0.1	0.0	0.1	0.5
Production market sector	%	− 0.1	0.0	0.1	0.3	0.7
Private consumption	%	− 0.4	− 0.6	− 0.7	− 0.7	0.2
Gross fixed investment. private non residential	%	0.0	0.0	0.1	0.3	1.1
Private residential investment	%	0.0	− 0.1	− 0.3	− 0.3	0.7
Exports of goods (non-energy)	%	0.1	0.2	0.3	0.5	0.6
of which domestically produced	%	0.1	0.4	0.6	1.0	1.2
re-exports	%	0.0	0.0	0.0	0.0	0.0
Imports of goods	%	− 0.1	− 0.1	− 0.1	0.0	0.3
Prices and wages						
Compensation per employee market sector	%	− 0.6	− 0.9	− 0.9	− 0.8	− 0.9
Contractual wages market sector	%	− 0.6	− 0.9	− 0.9	− 0.8	− 1.0
Consumer price index (CPI)	%	− 0.1	− 0.3	− 0.3	− 0.4	− 0.5
Exports price goods (excluding energy)	%	− 0.1	− 0.2	− 0.2	− 0.2	− 0.3
Price GDP	%	− 0.2	− 0.5	− 0.6	− 0.6	− 0.8
Price of gross value added market sector	%	− 0.2	− 0.5	− 0.6	− 0.7	− 0.9
Price competitiveness	%	0.1	0.3	0.3	0.3	0.4
Labour market						
Employment market sector (labour years)	%	0.0	0.1	0.1	0.2	0.5
Labour force (persons)	%	0.0	0.0	0.0	0.0	0.1
Unemployment rate (level in % labour force)	Δ	0.0	− 0.1	− 0.1	− 0.2	− 0.3
Miscellaneous items						
Labour productivity market sector	%	− 0.1	− 0.1	− 0.1	0.0	0.0
Individual savings rate (in % of disp. income)	Δ	− 0.2	− 0.1	0.0	0.1	0.1
Capacity utilisation rate market sector	Δ	− 0.1	− 0.1	− 0.1	0.0	0.2
Labour income share in enterprise income (level in %)	Δ	− 0.2	− 0.2	− 0.2	0.0	− 0.1
Net national income (volume)	%	− 0.2	− 0.2	− 0.2	− 0.1	0.2
General government financial balance (level in % GDP)	Δ	0.1	0.1	0.2	0.3	0.0
Taxes and social security contributions (level in % GDP)	Δ	− 0.2	− 0.2	− 0.2	− 0.2	− 0.6

% = cumulative relative difference.

Δ = cumulative absolute difference.

The effects on the EMU balance are positive from the outset. Because SAFFIER works with fixed social security contribution rates, the lower benefit payments do not lead to lower social security contributions. Even so, the tax burden will ease somewhat because the main taxes (payroll and income tax and value added tax) and social security contributions will fall more sharply than nominal GDP. If the improvement in the EMU balance were to be converted into lower payroll and income tax rates, then the economic effects over the medium term would be considerably more favourable. In the case of a balanced budget, domestic expenditure will develop much more positively, and this will not happen at the expense of the export performance.

5.8 A reduction of payroll and income tax by 1% of GDP

The effects of a reduction in payroll and income tax rates are explained on the basis of a variant in which this tax is cut *ex ante* by 1% of GDP. Because of the lighter tax burden, contractual wages will increase slightly more moderately than in the central path. The gain in purchasing power which households will enjoy thanks to the lighter tax burden will give a boost to private consumption. Consequently, production in the market sector will increase in the first year. A considerable proportion of the increase in consumer demand will seep abroad though imports, incidentally. Business investment will also increase in the first year, owing to the higher output and improving profitability. With a time lag the increase in real disposable incomes will also boost investments in residential dwellings. Employment will also increase. Because this variable responds with some delay to output trends, the increase in employment lags somewhat behind output growth in the early years, so that labour productivity in the market sector will improve somewhat.

Over the medium term, private consumption will increase gradually. This is because real disposable incomes (on the back of rising employment and higher real wages) will develop favourably, and because of positive wealth effects flowing from higher average house prices. Investments in residential dwellings will also help to boost output.
With a certain time lag, lower unemployment and higher real disposable incomes will lead to additional labour supply. But as this will increase by less than employment, unemployment will work out somewhat lower. After some time, this additional tension on the labour market will lead to higher wage rates, so that price competitiveness and profitability will come under some pressure. The effects of these developments will only occur at a later stage, however, and are not visible in the table.

The EMU balance will deteriorate because of the reduction in payroll and income tax rates. But owing to positive knock-on effects, this deterioration will be slightly less than the *ex ante* reduction in payroll and income tax.

Tabel 5.9 Effects of a reduction of payroll and income tax by 1% of GDP

Year		2007	2008	2010	2014
Effect after year t		1	2	4	8
		cumulative deviations from central projection			
Volumes					
Gross domestic product (GDP)	%	0.3	0.6	0.9	1.3
Production market sector	%	0.3	0.6	1.0	1.6
Private consumption	%	1.1	1.9	2.2	3.0
Gross fixed investment. private non residential	%	0.4	1.2	2.0	2.3
Private residential investment	%	0.1	0.8	2.4	3.9
Exports of goods (non-energy)	%	0.0	− 0.1	0.1	0.6
of which domestically produced	%	0.0	− 0.2	0.2	1.2
re-exports	%	0.0	0.0	0.0	0.0
Imports of goods	%	0.2	0.6	0.7	1.0
Prices and wages					
Compensation per employee market sector	%	− 0.2	− 0.4	− 0.6	− 0.3
Contractual wages market sector	%	− 0.3	− 0.4	− 0.6	− 0.3
Consumer price index (CPI)	%	0.0	0.0	− 0.2	− 0.3
Exports price goods (excluding energy)	%	0.0	0.0	− 0.1	− 0.2
Price GDP	%	− 0.1	− 0.1	− 0.4	− 0.4
Price of gross value added market sector	%	− 0.1	− 0.2	− 0.5	− 0.5
Price competitiveness	%	0.0	0.0	0.3	0.3
Labour market					
Employment market sector (labour years)	%	0.1	0.3	0.7	1.1
Labour force (persons)	%	0.0	0.1	0.3	0.5
Unemployment rate (level in % labour force)	Δ	0.0	− 0.2	− 0.3	− 0.5
Miscellaneous items					
Labour productivity market sector	%	0.2	0.2	0.1	0.1
Individual savings rate (in % of disp. income)	Δ	1.1	0.4	0.2	− 0.3
Capacity utilisation rate market sector	Δ	0.2	0.3	0.3	0.3
Labour income share in enterprise income (level in %)	Δ	− 0.3	− 0.4	− 0.2	0.1
Net national income (volume)	%	0.3	0.6	0.8	1.1
General government financial balance (level in % GDP)	Δ	− 0.9	− 0.8	− 0.8	− 0.7
Taxes and social security contributions (level in % GDP)	Δ	− 1.0	− 1.1	− 1.1	− 1.1

% = cumulative relative difference.

Δ = cumulative absolute difference.

5.9 An increase in the general VAT rate by 1% of GDP

No distinction is made in SAFFIER between the many types of indirect taxes. Value added tax (BTW or VAT) is by far the most important revenue earner among the indirect taxes. However, neither VAT in general or the high and low VAT rates are identified separately in SAFFIER, so that the implications of an increase in VAT revenues are simulated on the basis of a variant in which indirect taxes are raised autonomously. This hike is equivalent *ex ante* to 1% of GDP.

The higher VAT rate will lead to an increase in selling prices in the first instance, which will then have an upward effect on contractual wage rates. Given the assumed linkages and indexations, benefit payment levels will also be pushed upwards. But purchasing power will be lost, so that private consumption will fall. Investment activity will also decline, owing to a decline in output and a reduction in profitability. Moreover, exports will be adversely affected by the deterioration in price competitiveness. Overall GDP growth will decline by 0.2% in the first year compared to the central projection. In the following years, real GDP and market sector output will fall further. Consumption, investment and exports will all contribute to this downswing.

The higher VAT revenues will lead to an improvement in the EMU balance. But owing to negative knock-on effects, this improvement will remain limited. This means that in a balanced budget variant there will not be much scope to reduce payroll and income tax rates. Hence the positive effects of such a tax cut will also be modest. A reduction in payroll and income tax rates financed with a VAT hike that will leave the EMU balance unchanged will on balance have a negative effect on production volume after eight years.

Tabel 5.10 Effects of an increase of VAT rate by 1% of GDP

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	− 0.2	− 0.5	− 0.9	− 1.5	− 0.6
Production market sector	%	− 0.3	− 0.7	− 1.3	− 1.9	− 0.9
Private consumption	%	− 0.5	− 0.7	− 1.1	− 2.1	− 0.2
Gross fixed investment. private non residential	%	− 0.7	− 1.9	− 3.0	− 3.2	− 1.8
Private residential investment	%	0.0	− 0.2	− 1.0	− 2.7	− 0.1
Exports of goods (non-energy)	%	− 0.1	− 0.2	− 0.6	− 0.9	− 0.5
of which domestically produced	%	− 0.3	− 0.4	− 1.2	− 2.0	− 1.0
re-exports	%	0.0	0.0	0.0	0.0	0.0
Imports of goods	%	− 0.2	− 0.5	− 0.7	− 1.1	− 0.5
Prices and wages						
Compensation per employee market sector	%	0.6	0.6	0.2	− 1.5	− 1.5
Contractual wages market sector	%	0.7	0.6	0.3	− 1.4	− 1.4
Consumer price index (CPI)	%	1.1	1.2	1.3	1.0	0.8
Exports price goods (excluding energy)	%	0.2	0.3	0.3	0.2	0.0
Price GDP	%	1.3	1.5	1.6	0.9	0.7
Price of gross value added market sector	%	0.2	0.4	0.6	− 0.1	− 0.4
Price competitiveness	%	− 0.4	− 0.4	− 0.6	− 0.3	− 0.1
Labour market						
Employment market sector (labour years)	%	− 0.1	− 0.4	− 0.8	− 1.1	− 0.4
Labour force (persons)	%	0.0	− 0.1	− 0.2	− 0.4	0.0
Unemployment rate (level in % labour force)	Δ	0.0	0.3	0.6	0.7	0.3
Miscellaneous items						
Labour productivity market sector	%	− 0.2	− 0.2	− 0.2	− 0.4	− 0.3
Individual savings rate (in % of disp. income)	Δ	− 0.5	− 0.3	− 0.2	0.1	− 0.3
Capacity utilisation rate market sector	Δ	− 0.2	− 0.3	− 0.3	− 0.5	− 0.3
Labour income share in enterprise income (level in %)	Δ	0.7	0.5	0.1	− 0.6	− 0.4
Net national income (volume)	%	0.1	− 0.1	− 0.4	− 1.1	− 0.4
General government financial balance (level in % GDP)	Δ	0.9	0.7	0.5	0.3	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.7	0.7	0.6	0.4	− 0.1

% = cumulative relative difference.

Δ = cumulative absolute difference.

5.10 An increase in the general government's consumption of goods and services by 1% of GDP

The general government's consumption of goods and services consists of those goods and services which it buys from businesses and which are not allocated to public investment. The largest proportion of these purchases is made within the Netherlands. The general government's consumption of goods and services, also called "general government intermediate consumption", amounted to nearly EUR 35 billion in 2005 and accounted for around 15% of total public spending. The general government's consumption of goods and services together with benefits in kind and the wages of civil servants makes up total government consumption.

This variant gives an impulse to the public sector's consumption of goods and services by the equivalent of 1% of GDP. Such a consumption impulse will result in the first instance in an increase in GDP growth and market sector output. Consequently employment will also increase, albeit with a time lag. The lower unemployment and higher labour productivity will result in a higher increase in contractual wage rates and stronger wage drift. The higher increases in wages and employment will have an upward effect on private consumption. Investment will also develop more favourably, because of the higher output and the initial improvement in profitability. Domestically-produced exports will suffer, however, largely because of the deterioration of price competitiveness. Price competitiveness will deteriorate because the higher labour costs and a higher capacity utilisation rate will result in higher prices.

Over time the unfavourable effects of the higher wage increases will intensify steadily, so that the magnitude of the positive implications for economic growth will decline gradually. After about 10 years, only half of the initial positive impulse of 1% of GDP will remain, and after 15 years the GDP effect will be reduced to 0.2%. "Crowding out" (i.e. of the market sector by the public sector) will already be evident over the short term, since GDP growth will increase by less than the initial impulse of 1%, although this will have less of an impact in the early years.

Incidentally, the extent of crowding out is strongly linked to the assumption that official interest rates set by the European Central Bank (ECB) will not change as result of the additional public spending and the lower EMU balance in the Netherlands. If all euro zone countries were to increase the general government's consumption of goods and services and if the ECB responded to the higher inflation by raising interest rates, then the extent of crowding out would be considerably greater.

By way of illustration, we have also calculated the same variant coupled with an increase in long-term interest rates by 0.5 percentage points. In that case, the cumulative effect on GDP will only be 0.3% after four years, and after eight years GDP growth will actually work out 0.5% lower than in the central path. So the crowding out is more than total. It should be borne in mind, however, that this variant takes no account of the fact that higher interest rates will push up costs not only in the Netherlands but in all other euro zone countries as well. Hence the

Tabel 5.11 Effects of an increase of general government's consumption of goods and services by 1% of GDP

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	0.7	0.8	0.9	0.8	− 0.4
Production market sector	%	0.8	0.8	0.9	0.6	− 0.8
Private consumption	%	0.2	0.4	0.7	1.3	− 1.5
Gross fixed investment. private non residential	%	1.0	1.7	1.5	0.3	− 1.9
Private residential investment	%	0.0	0.2	0.7	1.7	− 1.5
Exports of goods (non-energy)	%	− 0.3	− 0.4	− 0.3	− 0.6	− 1.1
of which domestically produced	%	− 0.5	− 0.8	− 0.5	− 1.3	− 2.2
re-exports	%	0.0	0.0	0.0	− 0.1	− 0.1
Imports of goods	%	0.4	0.6	0.6	0.5	− 0.3
Prices and wages						
Compensation per employee market sector	%	0.6	0.6	1.3	2.4	2.8
Contractual wages market sector	%	0.5	0.6	1.2	2.4	2.8
Consumer price index (CPI)	%	0.2	0.2	0.3	0.8	1.1
Exports price goods (excluding energy)	%	0.1	0.2	0.2	0.4	0.6
Price GDP	%	0.3	0.3	0.6	1.5	1.9
Price of gross value added market sector	%	0.3	0.3	0.5	1.5	2.1
Price competitiveness	%	− 0.2	− 0.3	− 0.3	− 0.7	− 1.1
Labour market						
Employment market sector (labour years)	%	0.2	0.6	0.6	0.4	− 0.5
Labour force (persons)	%	0.0	0.1	0.2	0.2	− 0.3
Unemployment rate (level in % labour force)	Δ	− 0.2	− 0.5	− 0.5	− 0.2	0.2
Miscellaneous items						
Labour productivity market sector	%	0.6	0.2	0.2	0.2	0.1
Individual savings rate (in % of disp. income)	Δ	0.2	0.2	0.0	− 0.2	− 0.2
Capacity utilisation rate market sector	Δ	0.7	0.3	0.3	0.2	− 0.1
Labour income share in enterprise income (level in %)	Δ	− 0.3	0.0	0.4	0.4	0.5
Net national income (volume)	%	0.9	1.0	1.1	1.2	0.2
General government financial balance (level in % GDP)	Δ	− 0.7	− 0.6	− 0.6	− 0.8	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.0	0.0	0.1	0.2	1.4

% = cumulative relative difference.

Δ = cumulative absolute difference.

deterioration of price competitiveness and the accompanying loss of market share are overestimated in this variant.

The increase in the general government's consumption of goods and services will result in a deterioration of the EMU balance. But thanks to positive knock-on effects, this balance will

decline by less than 1% of GDP in the early years. If (in the balanced budget variant) the government decides to finance the higher public spending by raising payroll and income tax rates, then the economic effects will be considerably less favourable. Indeed, after eight years, GDP growth and market sector output will be around ½% lower than in the central path. The higher taxes will erode purchasing power, which will depress private consumption. Moreover, the higher tax burden will partly feed into higher wage rates, which will undermine price competitiveness and adversely affect domestically-produced exports. Investment will also come under pressure in this situation.

For the sake of completeness, we should reiterate that these calculations take no account of what are called the "programme effects" of public expenditures (see section 5.1).

5.11 An autonomous increase in the labour supply by 1%

An increase in the structural labour supply by 1% from 2007 is equivalent to an increase in the labour force by 77,000 people. In the first instance, this increase is expressed almost entirely in an increase in the number of unemployed job seekers. A proportion of these new job seekers receive a benefit, so that in the first year real disposable incomes and hence private consumption will work out somewhat higher than in the central path. But with a short time lag, the higher unemployment will have a depressing effect on the wages trends owing to which the demand for labour is growing, albeit gradually. Above all because of the higher unemployment, but also because of a fall in real disposable incomes, people will withdraw from the labour market after a period of time and the increase in the labour supply will moderate somewhat.

The wage moderation will translate into lower prices after the first year, so that price competitiveness will improve and domestically-produced exports will increase. Against this, however, private consumption will fall slightly after the second year. It emerges that the increase in the number of participants in the labour market does not offset the decline in real disposable income per worker or benefit recipient. Overall, production will increase over the short term, albeit very modestly. The higher growth will be accompanied by higher investment, sparked by the increased production and improved profitability.

After six or seven years, employment will have increased to such an extent (on the back of higher output, lower real income and higher profitability) that the additional labour supply will have been almost completely absorbed and unemployment will have virtually returned to the original level.[38] After eight years the larger structural labour supply will result in real GDP

[38] The speed with which the additional labour supply will be absorbed into the economy depends on the level of the replacement rate, or the balance between net unemployment benefit and net wages. If the replacement rate is high, then the downward pressure exerted on contractual wage rates by the initial increase in unemployment will be less than if the replacement rate is low.

around 0.7% higher than in the central path. After about eight years the depressing effect on private consumption and residential investment will peak, but then it will ease significantly. Over the even longer term, private consumption and residential investment will return to the central path, but this is not visible in the table.

Tabel 5.12 Effects of an autonomous increase of the laboursupply by 1%

Year		2007	2008	2010	2014
Effect after year t		1	2	4	8
		cumulative deviations from central projection			
Volumes					
Gross domestic product (GDP)	%	0.0	0.1	0.2	0.7
Production market sector	%	0.0	0.1	0.3	1.2
Private consumption	%	0.2	0.0	− 0.3	− 0.4
Gross fixed investment. private non residential	%	0.1	0.2	0.8	1.9
Private residential investment	%	0.0	0.0	− 0.2	− 0.6
Exports of goods (non-energy)	%	0.0	0.1	0.4	1.3
of which domestically produced	%	0.0	0.2	0.9	2.6
re-exports	%	0.0	0.0	0.0	0.1
Imports of goods	%	0.0	0.1	0.1	0.3
Prices and wages					
Compensation per employee market sector	%	0.0	− 1.0	− 2.2	− 2.5
Contractual wages market sector	%	0.0	− 1.0	− 2.1	− 2.5
Consumer price index (CPI)	%	0.0	− 0.2	− 0.7	− 1.1
Exports price goods (excluding energy)	%	0.0	− 0.1	− 0.4	− 0.6
Price GDP	%	0.0	− 0.4	− 1.2	− 1.9
Price of gross value added market sector	%	0.0	− 0.4	− 1.3	− 2.1
Price competitiveness	%	0.0	0.2	0.7	1.1
Labour market					
Employment market sector (labour years)	%	0.0	0.1	0.4	0.9
Labour force (persons)	%	0.9	0.8	0.8	0.9
Unemployment rate (level in % labour force)	Δ	0.9	0.7	0.4	− 0.1
Miscellaneous items					
Labour productivity market sector	%	0.0	− 0.1	− 0.2	− 0.1
Individual savings rate (in % of disp. income)	Δ	0.1	0.0	0.1	0.1
Capacity utilisation rate market sector	Δ	0.0	0.0	− 0.1	0.2
Labour income share in enterprise income (level in %)	Δ	0.0	− 0.5	− 0.6	− 0.3
Net national income (volume)	%	0.1	− 0.1	− 0.2	0.1
General government financial balance (level in % GDP)	Δ	− 0.1	− 0.2	− 0.2	0.1
Taxes and social security contributions (level in % GDP)	Δ	0.1	− 0.1	− 0.2	− 0.2

% = cumulative relative difference.

Δ = cumulative absolute difference.

The additional labour supply will lead to a deterioration in the EMU balance in the first four years by 0.1-0.2% of GDP. The wage moderation will have a downward effect on tax revenues, although this will be partly compensated by a higher number of taxpayers and higher corporation tax revenues. In the public spending sphere, the effect of greater income transfers arising from the higher unemployment will dominate in the early years. But in later years these additional outlays will fall, and the reduction in the civil service wages will become a more important factor. Over the medium term, the public sector will also benefit from the higher production volume. After eight years, the implications for the EMU balance will be slightly positive. But the improvement will be so small that no supplementary balanced budget variant has been calculated.

5.12 An increase in share prices by 20%

This variant analyses the effect of a 20% increase in the values of shares held by households. Generally speaking, a *permanent* increase in share prices will be based on a change in one or more fundamental economic variables, and in many cases this will be a global phenomenon. That is why a scenario analysis is most appropriate to assess the effects of permanently higher share prices, in which these higher share prices are accompanied by, for instance, an upward effect on world trade or a downward effect on the oil price. However, the variant simulated here is not a scenario, but a partial variant, in which the values of equities held by households increase permanently by 20% more than in the central path. We have not taken account of the fact that higher share prices will improve the financial positions of the pension funds, and that this could have a downward effect on pension contributions. The implications arise solely through a one-off increase in household wealth, and from that perspective they will underestimate what may happen in reality.

Over the short term the higher share prices will have an upward effect on private consumption, both through the higher level of shareholdings and the positive revaluation of that wealth. Consumers respond to their increased wealth with a certain time lag, but from the second year they will spend around ½% more than in the central path. The magnitude of the economic effects of an increase in share prices is determined primarily by the sensitivity of private consumption to changes in shareholdings. The experiences with the sharp share price falls in the first couple of years of this century suggest not only that this sensitivity is greater when prices *fall* (over the short term) than when they rise, but also that the impact on private consumption is faster when prices fall.[39] The magnitude of the effect depends in part on the seize of household share ownership, which, owing to the share price falls and the selling of equities, is currently lower than around the turn of the century. A 20% increase in share prices implies that

[39] See e.g. the CPB's *Central Economic Plan 2002*, p. 84.

household wealth will increase by around EUR 40 billion in 2007. This increase will boost consumer spending by around EUR 1 billion per year. This boils down to a marginal

Tabel 5.13 Effects of an increase in share prices by 20%

Year		2007	2008	2010	2014
Effect after year t		1	2	4	8
		cumulative deviations from central projection			
Volumes					
Gross domestic product (GDP)	%	0.1	0.1	0.1	0.1
Production market sector	%	0.1	0.1	0.1	0.0
Private consumption	%	0.4	0.5	0.4	0.5
Gross fixed investment. private non residential	%	0.1	0.3	0.2	0.0
Private residential investment	%	0.0	0.0	0.0	0.0
Exports of goods (non-energy)	%	0.0	− 0.1	0.0	− 0.1
of which domestically produced	%	0.0	− 0.1	− 0.1	− 0.1
re-exports	%	0.0	0.0	0.0	0.0
Imports of goods	%	0.1	0.2	0.1	0.1
Prices and wages					
Compensation per employee market sector	%	0.1	0.1	0.1	0.3
Contractual wages market sector	%	0.1	0.1	0.1	0.3
Consumer price index (CPI)	%	0.0	0.0	0.0	0.1
Exports price goods (excluding energy)	%	0.0	0.0	0.0	0.0
Price GDP	%	0.0	0.1	0.1	0.2
Price of gross value added market sector	%	0.0	0.1	0.1	0.2
Price competitiveness	%	0.0	− 0.1	0.0	− 0.1
Labour market					
Employment market sector (labour years)	%	0.0	0.1	0.1	0.0
Labour force (persons)	%	0.0	0.0	0.0	0.0
Unemployment rate (level in % labour force)	Δ	0.0	− 0.1	0.0	0.0
Miscellaneous items					
Labour productivity market sector	%	0.1	0.0	0.0	0.0
Individual savings rate (in % of disp. income)	Δ	− 0.1	− 0.2	− 0.1	− 0.1
Capacity utilisation rate market sector	Δ	0.1	0.1	0.0	0.0
Labour income share in enterprise income (level in %)	Δ	0.0	0.0	0.0	0.1
Net national income (volume)	%	0.1	0.2	0.1	0.1
General government financial balance (level in % GDP)	Δ	0.1	0.1	0.1	0.1
Taxes and social security contributions (level in % GDP)	Δ	0.0	0.1	0.1	0.1

% = cumulative relative difference.

Δ = cumulative absolute difference.

consumption ratio of 0.025, which coincides with the empirically-found coefficient for shareholdings in the short-term consumption equation (see section 4.2).

The positive effects on private consumption will have an impact on production volume. Because the imports of consumer goods will increase, some of the demand impulse will seep

abroad, so that the positive effect on real GDP will be limited to 0.1%. The higher economic growth will have a slight upward effect on business investment. The lower unemployment and higher labour productivity will lead to slightly higher contractual wage rates, which will erode price competitiveness and hence depress domestically-produced exports somewhat over time. With the exception of private consumption, the economic implications of a 20% increase in share prices will be small in this partial variant. The EMU balance will improve slightly. That is why the economic effects in the balanced budget variant will be slightly more favourable.

Effects of a temporary increase in share prices

The effects of a temporary increase in share prices will be appreciably smaller than those of a permanent increase. If the shareholdings of households are worth 20% more than in the central path over a one-year period, but then return to their original level in the following year, the effects in the first year will be identical to those in table 5.13. In the second year, when share prices fall again and return to their level in the central path, the effect will already be appreciably smaller. Private consumption will only be 1⁄4% higher, while the effect on GDP growth will be virtually halved compared to the effect of a permanent increase in share prices. In the following years, the effects of a temporary increase in share prices will ebb away. After the third year, all volume and price effects will be nil, and share prices will be at their original levels in the central path.

5.13 An autonomous increase in average house prices by 10%

This variant simulates the effects of a permanent increase in average house prices by 10% at the start of the year. This is an autonomous increase, in other words not one which flows from a change in one of the fundamental economic factors determining house prices, such as real interest rates, real disposable incomes or the supply of new homes.

Both the positive revaluation of housing wealth and the higher level of housing wealth will have a positive effect on private consumption in the first year. The higher consumption will result in higher production, which will also give a boost to business investment. Domestically-produced exports will decline somewhat, however, because the increase in the capacity utilisation rate will adversely affect exports, both directly (via what is known as the "home pressure of demand" effect) and indirectly (via upward pressure on export prices). Moreover, the pressure on wages associated with lower unemployment will have an upward effect on export prices, and hence an unfavourable effect on price competitiveness. In the first year, GDP growth will increase by 0.3% more than in the central path.[40]

In the following years, the upward effect on consumption and production will strengthen somewhat, because consumers will respond to the increase in housing wealth with a time lag. Over the medium term, output growth will be around ½% higher than in the central path.

[40] The short-term effect on consumption and production is somewhat less than in the SAFE model. See CPB (2003b), p. 95. This is connected with the introduction of the so-called additional loan regulation (bijleenregeling) on 1 January 2004, which makes the withdrawal of home equity for consumption less attractive in tax terms. See also section 4.2.

Tabel 5.14 Effects of an autonomous increase in average houseprices by 10%

						Balanced Budget
Year		2007	2008	2010	2014	2014
Effect after year t		1	2	4	8	8
		cumulative deviations from central projection				
Volumes						
Gross domestic product (GDP)	%	0.3	0.4	0.4	0.5	1.0
Production market sector	%	0.3	0.4	0.5	0.6	1.2
Private consumption	%	1.1	1.6	1.6	1.8	3.1
Gross fixed investment. private non residential	%	0.4	1.0	1.2	1.1	2.2
Private residential investment	%	0.0	0.1	0.4	1.3	2.7
Exports of goods (non-energy)	%	− 0.1	− 0.3	− 0.1	0.0	0.2
of which domestically produced	%	− 0.1	− 0.5	− 0.2	0.1	0.5
re-exports	%	0.0	0.0	0.0	0.0	0.0
Imports of goods	%	0.2	0.6	0.5	0.5	0.9
Prices and wages						
Compensation per employee market sector	%	0.3	0.5	0.2	0.6	0.4
Contractual wages market sector	%	0.3	0.5	0.2	0.6	0.3
Consumer price index (CPI)	%	0.2	0.4	0.2	0.2	0.1
Exports price goods (excluding energy)	%	0.0	0.1	0.0	0.1	0.0
Price GDP	%	0.3	0.5	0.3	0.4	0.2
Price of gross value added market sector	%	0.2	0.4	0.1	0.3	0.0
Price competitiveness	%	− 0.1	− 0.3	0.0	− 0.1	0.0
Labour market						
Employment market sector (labour years)	%	0.0	0.2	0.3	0.4	0.8
Labour force (persons)	%	0.0	0.0	0.1	0.2	0.4
Unemployment rate (level in % labour force)	Δ	0.0	− 0.2	− 0.2	− 0.2	− 0.4
Miscellaneous items						
Labour productivity market sector	%	0.3	0.1	0.1	0.0	0.1
Individual savings rate (in % of disp. income)	Δ	− 1.1	− 1.8	− 1.9	− 1.9	− 1.9
Capacity utilisation rate market sector	Δ	0.3	0.2	0.1	0.1	0.2
Labour income share in enterprise income (level in %)	Δ	− 0.1	− 0.1	0.0	0.2	0.2
Net national income (volume)	%	0.3	0.6	0.5	0.6	1.0
General government financial balance (level in % GDP)	Δ	0.2	0.3	0.3	0.4	0.0
Taxes and social security contributions (level in % GDP)	Δ	0.1	0.0	0.0	0.0	− 0.5

% = cumulative relative difference.

Δ = cumulative absolute difference.

The higher house prices will be a boon for the government. The EMU balance will be positively affected by higher consumption (translating into higher value added tax revenues), higher wages (higher payroll and income tax revenues) and lower unemployment benefit payment volumes. If (in the balanced budget variant) the government decides to pass the improvement in the public finances on to citizens in the form of lower payroll and income tax rates, then the

economic effects will be even more favourable. The consequent gain in purchasing power will give a further boost to private consumption. And the higher net real income will give an additional stimulus to the labour supply, which will also benefit the economy’s performance.

Appendix A The key behavioural equations in SAFFIER

A.1 Introduction

The notation used in the equations described below follows algebraic conventions. Unless stated otherwise, upper case letters denote the value amount in current prices, and lower case letters denote volumes [41] or ratios. Prices are indicated by means of the letter '*p* ', followed by a subscript referring to the variable concerned. A small circle (°) above a variable indicates a relative change on a quarterly basis, while a Δ denotes an absolute change.

Since relative and absolute changes are always expressed in relation to the previous quarter, a factor *fp* = 4 sometimes appears in the equations to indicate that they are expressed on a yearly basis. In addition, all behavioural equations are estimated on a yearly basis, so that where necessary the estimated coefficients are included with a factor of 4 or ¼ in the equations on a quarterly basis. The situations in which this applies include the use of a stock variable (such as the stock of residential dwellings), which on a quarterly basis would be approximately equal to the quantity on a yearly basis, to explain a flow variable (such as consumption) of which the quantity per quarter would, on a yearly basis, usually be about equal to a quarter of that quantity. To make allowance for this, the coefficients of the stock determinant are divided by 4. The reverse, too, may occur.

Ratios and relative changes are denoted in units. Interest rates and profitability, on the other hand, are denoted in percentages. For this reason, a factor of 100 is shown with the coefficients of these variables in the equations concerned. Lastly, it should be noted that all data used in the model have been adjusted for seasonal influences. Because all quarters are dealt with in the same way, the (estimated) equations do not incorporate seasonal dummy variables.

In the following part the most important behavioural equations in SAFFIER are presented. For an explanation on the chosen specification of these equations see the CPB Documents on SAFE (CPB, 2003b) and JADE (CPB, 2003a). In addition some specific parts of the model are explained in seperate publications:

- **Public sector**

  See B.J. Kuipers, F. Bos, N.M. Bosch, P. Eering, D. Kingma, M.P.D. Ligthart, S.J. Ottens, G. Romijn en H.W. Stegeman (2004), Collectieve sector in SAFE, CPB Memorandum 106.

[41] Strictly speaking, the model differentiates between three kinds of volumes, namely in terms of the previous yearŠs prices, previous quarterŠs prices and the prices of a fixed basic year. For the sake of simplicity, the description of the equations in this memorandum makes use of lower case letters for all three kinds of volumes.

- **Housing prices**

  See J.P. Verbruggen, H.C. Kranendonk, M. van Leuvensteijn en M.J.M.A. Toet (2005), Welke factoren bepalen de ontwikkeling van de huizenprijs in Nederland?, CPB Document 81.
- **Private consumption**

  See H.C. Kranendonk en J.P. Verbruggen (2001), De nieuwe consumptiefunctie van SAFE, CPB Memorandum 18.
- **Domestically produced exports en re-exports**

  See A.P. Kusters, M.P.D. Ligthart en J.P. Verbruggen (2001), De nieuwe uitvoervergelijkingen van SAFE, CPB Memorandum 25.
- **Productionfunction**

  See D.A.G. Draper, F.H. Huizinga en H.C. Kranendonk (2001), Potentiële groei volgens de productiefunctiebenadering, CPB Memorandum 4.
- **Stockbuilding**

  See B.J. Kuipers (2006), Een vergelijking voor de voorraadvorming in SAFFIER, CPB Memorandum 141.

A.2 The market for goods and services

A.2.1 Supply of goods and services, productioncapacity

To incorparate the productionfactors labour and capital SAFFIER uses a CES-productionfunction. The amount of labour is expressed in efficiency-units because in the course of time a certain amount of labour in a year produces increasingly more thanks to labour saving technological progress.[42] In addition the average of yearly worked hours of a full time worker is taken into account. The operation time of capital is kept constant while the technological progress of capital is assumed to be zero. The simplified productionfunction is as follows:

$$y = [\lambda^{\frac{1}{\sigma}} a_e^{\frac{\sigma-1}{\sigma}} + (1-\lambda)^{\frac{1}{\sigma}} k^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{A.1}$$

with

$$a_e = a\, d_l\, e^{v_l^*} \tag{A.2}$$

where all variables refer to the market sector:

y gross value added

a_e labour input in efficiency units

[42] Aggregate technological progress, the so-called Solow residual or Total Factor Productivity (TFP), is equal to $\lambda \Delta v_l$. Since there is no capital-saving technological progress, TFP growth may be allocated in full to labour. The progress in labour-saving techniques v_l may therefore also be labelled as the TFP growth imputed to labour. The structural progress in labour-saving techniques v_l^* has been derived from the actual progress in labour-saving techniques with the help of a Hodrick-Prescott filter.

a employment (labour years)

d_l working time of labour (hours per labour year)

v_l^* structural degree of labour-saving technical progress

k capital stock

λ constant

σ elasticity of substitution between labour and capital

The optimal use of labour and capital, that is the long-term demand for labour and capital, in a logarithmic specification looks as follows: [43]

$$\ln a^* = \ln \lambda + \ln y - \sigma \ln \left(\frac{p_{le}}{cy} \right) - v_l^* - \ln d_l \tag{A.3}$$

$$\ln k^* = \ln(1-\lambda) + \ln y - \sigma \ln \left(\frac{p_k}{cy} \right) \tag{A.4}$$

where all variables refer to the market sector:

a^* long-term demand for labour (labour years)

k^* long-term demand for capital

cy minimal cost per unit output (according to production function)

p_{le} labour costs in efficiency units

p_k capital costs

The equations as referred to above were estimated resulting in the following parameters-values:[44] $\lambda = 0.72$ and $\sigma = 0.32$. The optimal demand for labour and capital, apart from the actual production, mainly depends on the relative labour costs (p_{le}/cy) and capital costs (p_k/cy) respectively. Based on the production function the minimal costscan be calculated as:

$$cy = [\lambda \, p_{le}^{1-\sigma} + (1-\lambda) \, p_k^{1-\sigma}]^{\frac{\sigma}{\sigma-1}} \tag{A.5}$$

with:

$$p_{le} = \frac{p_l}{d_l \, e^{v_l^*}} \tag{A.6}$$

where all variables refer to the market sector:

cy minimal cost per unit output (according to production function)

p_{le} labour costs in efficiency units

[43] The optimum demand for labour in the market sector is not equal to structural market sector employment, which determines the potential production in this sector. After adjustment for the NAIRU and employment in the non-market sector, structural employment is determined by reference to the structural supply of labour in the economy, whereas we are concerned here with the optimum demand for labour by reference to production and relative labour costs in the market sector, among other things.

[44] See Draper, Huizinga and Kranendonk (2001).

p_l wage rate

p_k capital costs

Capital costs are defined as a function of the effective investment price, the depreciation rate and the real rate of interest after taxes. [45] Subsequently the relative labour costs (p_{le}/cy) and relative capital costs (p_k/cy), which play a major part in the demand for production factors, can be calculated.

A.2.2 Private consumption

In the modelling of the private consumption it is taken into account that in three categories the consumer has little freedom of choice. These categories (rents on house ownership, private healthcare and administration costs of pensionfunds and life insurance companies) are exogenous. The endogenous part of the consumption referred to as free consumption incorporates seperate equations for the short and the long term.

The long term equation distinguishes two types of households. The first type has access to the capital market and behaves in accordance with the lifecycle theory. This implies that decisions regarding laboursupply and investments are taken before decisions regarding consumption. Consequently lifetime wealth is exogenous in the decision on consumption. Households have a finite life with a constant death hazard rate λ. Savings are regarded as an instrument to smooth consumption over time with a constant intertemporal substitution elasticity ε and time preference rate β. The parameter θ represents the sum of death hazard rate, expected lifetime rise in wagerates and a risk premium.

Three sources of income are distinguished: disposable labour income[46], disposable benefit income and disposable profit income. This last category depends on the profits of the wealth of households (Wg). De 'free' consumption of households with an entrance on the capital market is represented by the following long-term equation:

$$C_{vr}^{k*} = [\varepsilon(\beta+\lambda)+(1-\varepsilon)(r_{\ell n}-\mathring{p}_c^e * fp+\lambda)]\left(Wg_{-1}+\frac{LDA_k+ODA_k}{r_{\ell n}-\mathring{p}_{ln}^e * fp+\theta}\right) \tag{A.7}$$

where:

C_{vr}^{k*} Long-term 'free' private consumption of households with access to the capital market

$r_{\ell n}$ long-term interest rate net of taxes: $r_{ln} = (1-tcl-psl)r_l$

r_l long-term interest rate

tcl rate of direct taxes paid by labour

psl social security contribution rate for employees

[45] See section A.2.6.

[46] Includes labourincome of selfemployed but excludes the private healthcare consumption as well as administration costs of pensionfunds and life insurance companies.

p_c^e expected price of 'free' private consumption[47]

Wg net wealth of households (excluding pension rights)

LDA_k disposable households' wage income (see note 46)

ODA_k disposable benefit income, excluding transfers related to medical expenses

p_{ln}^e expected net wage rate[48]

Table A.1 gives an overview of the parametervalues of the estimated long-term equation

Table A.1 Parametervalues long-termequation SAFFIER

$\varepsilon = 0.85$	$\phi_l = 0.63$	$\theta = 0.23$
$\beta = 0.03$	$\phi_u = 0.81$	$\lambda = 0.009$

The second type of households has no entrance to the capital market. These households are likely to consume their total disposable income. The total income of these households is a fraction ϕ_l of the total disposable labourincome and a fraction ϕ_u of the total disposable benefitincome. These households are not supposed to have any other income. This means that the long-term equation of the 'free' consumption of all households is as follows:

$$C_{vr}^* = \{\varepsilon(\beta+\lambda)+(1-\varepsilon)(r_{\ell n}-\mathring{p}_c^e * fp+\lambda)\}\cdot \tag{A.8}$$

$$\left(Wg_{-1}+\frac{(1-\varphi_\ell)LDA_k+(1-\phi_u)ODA_k}{r_{\ell n}-\mathring{p}_{ln}^e * fp+\theta}\right)+\varphi_\ell LDA_k+\varphi_u ODA_k$$

where:

C_{vr}^* long-term 'free' private consumption (all households)

The short-time equation of private consumption is as follows:

$$\mathring{c}_{vr} = 0.55\cdot\frac{g_6(\Delta lda_k)}{(C_{vr})_{-1}}+0.69\cdot\frac{g_{16}(\Delta oda_k)}{(C_{vr})_{-1}}+0,37\cdot\frac{\Delta zda_k}{(C_{vr})_{-1}}-0.60\Delta r_{\ln} \tag{A.9}$$

$$+\frac{0.025}{fp}\cdot\frac{g_{13}(\Delta hw)}{(C_{vr})_{-1}}+\frac{0.035}{fp}\cdot\frac{g_{13}(\Delta w_{-2}^h)}{(C_{vr})_{-1}}+\frac{0.025}{fp}\cdot\frac{g_{13}(\Delta ha)}{(C_{vr})_{-1}}$$

$$+\frac{0.033}{fp}\cdot\frac{g_{13}(\Delta w_{-2}^a)}{(C_{vr})_{-1}}+\frac{0.054}{fp}\cdot\frac{g_{13}(\Delta w_{-2}^r)}{(C_{vr})_{-1}}-\frac{0.15}{fp}(\ln c_{vr}-\ln c_{vr}^*)_{-1}$$

where:

[47] p_c^e is calculated as a distributed lagfunction of the actual inflation.

[48] p_{ln}^e is calculated as a distributed lagfunction of the actual net wage rate

c_{vr} ‘free’ private consumption

zda_k disposable households’ profit income, excluding cwe and c_a

cwe imputed rents on owner occupied houses

c_a administration costs of pensionfunds and life-insurance companies

w^h household’s housing wealth

w^a households’ stock wealth

w^r other assets of households (total households’ assets minus mortgages and other debts)

ha revaluation of households’ stock wealth (Δw^a)

hw revaluation of households’ housing wealth (Δw^h)

In case of a substantial fall in share prices the term $\frac{0.033}{fp}\frac{g_{13}(\Delta w^a_{-2})}{(C_{vr})_{-1}}$ is replaced by $\frac{0.054}{fp}\frac{g_{15}(\Delta w^a_{-1})}{(C_{vr})_{-1}}$.

A.2.3 Exports of goods and services

Volume of domestically produced exports of goods

Long-term equation:[49]

$$\ln bfb^* = 1.0\ln mwf - 4.0(\ln p_{bfb} - \ln p_{bfc}) - 0.008(tr_{70}) \tag{A.10}$$

Short-term equation

$$\begin{aligned} \mathring{bfb} = {} & 1.05\,\mathring{mwf} - 0.76\,(\mathring{p}_{bfb} - \mathring{p}_{bfc}) + \frac{0.54}{fp}\,g_2(i^{vi}_{qn} - i^{bu}_{qn})_{-fp} \\ & - 0.41\,g_3(\Delta qy^{vi}) - \frac{0.18}{fp}(\ln bfb - \ln bfb^*)_{-1} \end{aligned} \tag{A.11}$$

where:

bfb exports of domestically manufactured goods

bfb^* long-term level of domestically produced exports of goods

mwf relevant world trade

p_{bfb} price of domestically produced exports of goods

p_{bfc} price of competitors’ exports

tr_{70} trend, since 1970 (1970=1, 1971=2, 1972=3 etc.)

i^{vi}_{qn} investment ratio manufacturing industry

i^{bu}_{qn} weighted average of i^{vi}_{qn} in competing countries

qy^{vi} capacity utilisation rate manufacturing industry

[49] In the long-term equation the trendterm equals − 0.024. Afterwards new timeseries (published by Statistics Netherlands) have been incorperated in the datamodel, after which the trendterm is calibrated on (− 0.008) resulting in a residu around zero in the long-term equation

Volume of re-exports

Long-term equation:

$$\ln bfm^* = 1.0 \ln mwf + 1.0 (\ln mws - \ln mwf) * dum_s - 0.56 (\ln p_{bfm} - \ln p_{bfc}) + 0.12\, dum_{88} + 0.045\, tr_{93} \quad \text{(A.12)}$$

Short-term equation:

$$\mathring{bfm} = 0.76\, \mathring{mwf} + 0.32 \left(\mathring{mws} - \mathring{mwf} \right) * dum_s - 0.35 (\mathring{p_{bfm}} - \mathring{p_{bfc}}) + 0.12 \Delta (tr_{93}) - \frac{0.43}{fp} (\ln bfm - \ln bfm^*)_{-1} + 0.065\, \Delta\, dum_{88} \quad \text{(A.13)}$$

where:

bfm	re-exports
bfm^*	long-term level of re-exports
mwf	relevant world trade
p_{bfm}	price of re-exports
p_{bfc}	price of competing exports excluding energy, doubly reweighted
tr_{93}	trend since 1993 (1993=1, 1994=2, 1995=3 etc.) related to the integration of the EU-market
mws	international trade of semiconductors
dum_{88}	dummy since 1988=1, before that 0
dum_s	dummy correction semiconductors (since 1996=1, before 0)

Exports of services

Long-term equation:

$$\ln bd^* = 1.0 \ln mwf - 1.65 (\ln p_{bd} - \ln p_{bdc}) \quad \text{(A.14)}$$

Short-term equation:

$$\mathring{bd} = 1.0\, \mathring{mwf} - \frac{0.33}{fp} (\ln bd - \ln bd^*)_{-1} \quad \text{(A.15)}$$

where:

bd	volume exports of services
bd^*	longterm level of exports of services
mwf	relevant world trade
p_{bd}	exportprice services
p_{bdc}	exportprice services competitors

A.2.4 Business investments

Investments in residential buildings

Long-term equation:

$$\ln iw^* = 1.0\,\mathrm{g}_{24k2}(lda) - 0.05\,\mathrm{g}_{4k2}(rl) \tag{A.16}$$

Short-term equation:

$$\mathring{iw} = 1.30\,\mathrm{g}_{24k2}(\mathring{lda}) - 0.05\,\mathrm{g}_{4k2}(\Delta r_l) - \frac{0.10}{fp}(\ln iw - \ln iw^*)_{-1} \tag{A.17}$$

where:

iw	investment in residential buildings (excluding transfer costs)
iw^*	long-term investment in residential buildings (excluding transfer costs)
lda	real disposable wage income, including imputed wages of self-employed and excluding private health care consumption
r_l	long-term interest rate

Business investments in other fixed assets

Short-term equation investments in non-residential buildings:

$$(i^b/k^b_{-1}) = 0.65\,\mathrm{g}_{25k4}(\mathring{k}^b) + 0.06\,\mathrm{g}_{s22}(\mathring{y}) + 0.04\,\mathrm{g}_{s22k4}(\mathring{y}) \tag{A.18}$$

$$- 0.05(\mathrm{g}_{s22}(\mathring{p}^b_k) - \mathrm{g}_{s22}(\mathring{cy})) + \frac{0.03}{fp}\ln(\mathrm{g}_{s22}(p_y/c))$$

$$- \frac{0.017}{fp}(\ln k^b - \ln k^{b*})_{-1} + \delta^b$$

Short-term equation investment in equipment:

$$(i^{ot}/k^{ot}_{-1}) = 0.4\,\mathrm{g}_{25k4}(\mathring{k}^{ot}) + 0.14\,\mathrm{g}_{22}(\mathring{y}) + 0.09\,\mathrm{g}_5(\mathring{y}) \tag{A.19}$$

$$- 0.021(\mathrm{g}_5(\mathring{p}^{ot}_k) - \mathrm{g}_5(\mathring{cy})) + \frac{0.14}{fp}\ln(\mathrm{g}_5(p_y/c))$$

$$- \frac{0.045}{fp}(\ln k^{ot} - \ln k^{ot*})_{-1} + \delta^{ot}$$

Long-term equation long-term capital demand:

$$k^{ot^*} = \ln(0.276y) - 0.32\ln\frac{p^{ot}_k}{cy} \tag{A.20}$$

$$k^{b^*} = \ln(0.276y) - 0.32\ln\frac{p^{b}_k}{cy} \tag{A.21}$$

where all variables refer to the market sector:

i^b	investment in non-residential buildings
k^b	capital stock in non-residential buildings

k^{b*} long-term capital demand for non-residential buildings

y gross value added

p_k^b capital costs of non-residential buildings

cy minimal cost per unit output (according to production function)

c average cost price

p_y price of gross value added

i^{ot} investment in equipment

k^{ot} capital stock in equipment

k^{ot*} long-term capital stock in equipment

p_k^{ot} capital costs of equipment

δ^b rate of depreciation of k^b (0.0275)

δ^{ot} rate of depreciation of k^{ot} (0.097)

Stock building

$$n = 0.58\,n_{-1} + 0.11 fp\ \mathrm{g}_{13k1}(\Delta vc) - 0.08 fp\,\Delta vc - 0.02 fp\ \mathrm{g}_{13k1}(\Delta r_v) \qquad \text{(A.22)}$$

$$- 17.50 fp\,\mathring{P}_k^n + 9.70 fp\ \mathrm{g}_{13k1}(\mathring{P}_k^n)$$

where:

n stock building

Δvc domestic sales and exports

r_v real interest rate, relevant for stockbuilding

Pk^n production costs stockbuilding

In the long term the ‘stock-sales ratio’ equals 7% $(0.11 - 0.08)$ / $(1 - 0.58)$.

A.2.5 Imports of goods and services

Final Imports of goods and services

Consumer goods

Long-term equation:

$$\ln mc^* = 1.0 \ln cre - 1.41(\ln p_{mc} - \ln p_{cre}^{bh}) - 0.1 tr93 \qquad \text{(A.23)}$$

Short-term equation:

$$\mathring{mc} = 1,48\,\mathring{cre} - 0,63(\mathring{p}_{mc} - \mathring{p}_{cre}^{bh}) - 0,09\,\Delta tr93 - \frac{0,20}{fp}(\ln mc - \ln mc^*)_{-1} \qquad \text{(A.24)}$$

where:

mc import of consumer goods (excluding energy)

mc^* long-term import of consumer goods

cre 'free' private consumption

p_{mc} price of m_c

p_{cre}^{bh} price of domestically produced 'free' private consumption

$tr93$ trend since 1993 (1993=1, 1994=2 etc.)

Investment goods

Long-term equation:

$$\ln mi^* = 1.0 \ln ibc - 0.45 \left(\ln p_{mi_{-1}} - \ln p_{ibo}^{bh}\right) + 2.17 qy_i + \left\{\left(\frac{i^{vl}}{mi}\right)\right\}_{-1} \ln i^{vl} \tag{A.25}$$

Short-term equation:

$$\mathring{m}i = 1.13 \mathring{ibc} - 0.48\, g_{5k1}(\mathring{p}_{mi} - \mathring{p}_{ibo}^{bh}) + 0.99\, g_{5k1}(\Delta qy_i) \tag{A.26}$$

$$+ \left\{\left(\frac{i^{vl}}{mi}\right)_{-1}\right\} \mathring{i}^{vl} - \frac{0.28}{fp}(\ln mi - \ln mi^*)_{-1}$$

where:

mi imports of investment goods

mi^* long-term imports of investment goods

ibc investment in equipment

p_{mi} price of m_i

p_{ibo}^{bh} price of domestically produced capacity creating investment goods

qy_i capacity utilisation rate industry

i^{vl} private investment in aircrafts

Tourism services

Long-term equation:

$$\ln mdc^* = 1.0 \ln cre - 0.60(\ln p_{mdc} - \ln p_c) \tag{A.27}$$

Short-term equation:

$$\mathring{mdc} = 1.54 \mathring{cre} - 0.45(\mathring{p}_{mdc} - \mathring{p}_c) - \frac{0.11}{fp}(\ln mdc - \ln mdc^*)_{-1} \tag{A.28}$$

where:

mdc imports of tourism services

mdc^* long-term imports of tourism services

cre 'free' private consumption

p_{mdc} price of m_{dc}

p_c private consumption price

Intermediate imports

Imports of intermediate goods

Long-term equation:

$$\ln mgr^* = \ln vmg - 0.34(\ln p_{mgr} - \ln p_{vmg}) \tag{A.29}$$

Short-term equation:

$$\mathring{mgr} = 1.0\,\mathring{vmg} - 0.28(\mathring{p}_{mgr} - \mathring{p}_{vmg}) + 0.55\left(\frac{\Delta n}{MGR_{-1}}\right) - \frac{0.42}{fp}(\ln mgr - \ln mgr^*)_{-1} \tag{A.30}$$

where:

mgr imports of raw materials and semi-manufactures (excluding energy)

mgr* long-term imports of raw materials and semi-manufactures (excluding energy)

vmg final sales of domestically manufactured products, reweighted to their importshare (*mgr*)

p_{mgr} price of *mgr*

p_{vmg} price of *vmg*

n stock building

Imports of intermediate services

Long-term equation:

$$\ln mdb^* = 1.0\ln vmd - 0.34(\ln p_{mdb} - \ln p_{vmd}) \tag{A.31}$$

Short-term equation:

$$\mathring{mdb} = 1.0\,\mathring{vmd} - 0.28(\mathring{p}_{mdb} - \mathring{p}_{vmd}) - \frac{0.42}{fp}(\ln mdb - \ln mdb^*)_{-1} \tag{A.32}$$

where:

mdb imports of intermediate services

mdb* long-term level of imports of intermediate services

vmd final sales of domestically manufactured products, reweighted to their importshare (*mdb*)

p_{mdb} price of *mdb*

p_{vmd} price of *vmd*

Energy imports

Long-term equation:

$$\ln m3^* = 1.0\ln vm3 - 0.10(\ln p_{m3} - \ln p_{vm3}) \tag{A.33}$$

Short-term equation:

$$\mathring{m3} = 1.0\,\mathring{vm3} - 0.05(\mathring{p}_{m3} - \mathring{p}_{vm3}) - \frac{0.10}{fp}(\ln m3 - \ln m3^*)_{-1} \tag{A.34}$$

where:

m3 imports of energy

*m3** long-term level of imports of energy

vm3 final sales of domestically manufactured products, reweighted to their importshare (*m3*)

p_{m3} price of *m3*

p_{vm3} price of *vm3*

A.2.6 Prices and costs

For the most important output categories SAFFIER contains two types of prices, namely final output prices and prices of domestically produced goods and services. The final output price of each category is calculated on the basis of the relevant price of the domestically produced output, the relevant importprice of final goods and the indirect tax burden (including price reducing subsidies).

Cost equations

SAFFIER calculates production unit costs for twelve expenditure categories (see table A.2). The subsequent types of costs are as folowes:

- unit labour costs;
- costs of imported intermediates split into raw materials and semi-manufactures, services and energy;
- costs of domestically produced natural gas;
- user costs of capital.

The development of these types of product unit costs are weighted with the help of cumulated costshares. These are derived from the input-output tables published on a yearly basis by Statistics Netherlands. The average costs per unit of product is as follows: [50]

$$\mathring{k}_j = (1-g_j-s_j-o_j-a_j-\lambda_j)_{-fp}\left[\mathrm{g}_1(\mathring{p}_{lle}) - \left(\mathrm{g}_2(\mathring{h}_l^{ms}) + \frac{\eta_j}{100*fp}\right)\right] \qquad \text{(A.35)}$$

$$+\lambda_{j_{-fp}}\,\mathrm{g}_{24}(\mathring{p}_{k,j}-\mathring{h}_k)+g_{j_{-fp}}\,\mathrm{g}_{23}(\mathring{p}_{mgr}-\mathring{h}_{mgr})+s_{j_{-fp}}\,\mathrm{g}_{23}(\mathring{p}_{mdb}-\mathring{h}_{mdb})$$

$$+o_{j_{-fp}}\,\mathrm{g}_{23}(\mathring{p}_{m3}-\mathring{h}_{m3})+a_{j_{-fp}}\mathring{p}_{vag}$$

where:

k_j units costs for (domestically produced) demand category j

[50] In case of the product unit costs of investments related to building activities and of export categories the intermediate importprices are subject to a g_8- time lag function.

p_{lle} private sector wage rate, excluding wage costs subsidies

h^{ms} labour productivity market sector

h_k productivity of capital

h_{mgr} productivity of imported raw materials and semimanufactures (excluding energy)

h_{mdb} productivity of imported intermediate services

h_{m3} productivity of imported energy (SITC 3)

$p_{k,j}$ user costs of capital demand category j

p_{mgr} price of imported raw materials and semimanufactures (excluding energy)

p_{mdb} price of imported intermediate services

p_{m3} price of imported energy (SITC 3)

p_{vag} price of natural gas consumption by enterprises

g_j cumulated cost share of imported raw materials and semi-manufactures of demand category j

s_j cumulated cost share of imported intermediate services of demand category j

o_j cumulated cost share of imported energy of demand category j

a_j cumulated cost share of natural gas consumption by enterprises of demand category j

λ_j cumulated capital cost share of demand category j

η_j difference between structural labour productivity growth relevant for demand category j and market sector's structural labour productivity growth

Productivity is measured as the use of the productionfactor per unit production (not value added). For the determination of capital costs a distinction is made between user costs of equipment and buildings. The usercosts in SAFFIER are based on the formulas out of JADE. [51] The real long-term interest rate as well as the real return on alternative investments play a role in this equation. For the past and the future the fiscal regime with respect to taxes on profits and wealth as well as the subsidies on investments is taken into account as much as possible.

Table A.2 shows the cumulated costshares and the additive factor of the most important demand categories.

[51] See CPB (2003a), paragraph 2.1.1. and Draper and Huizinga (2001).

Table A.2 Cumulated cost shares and additive productivity factors (n_j) for demand categories, 2003

	Cost components						
	Labour	Import of raw materials and semi-manufactures	Import of services	Import of energy	Domestic natural gas consumption	Capital	
		g_j	s_j	o_j	a_j	λ_j	η_j
Private consumption							
Total excluding fixed expenses	0.54	0.12	0.10	0.02	0.01	0.22	− 0.80
Medical services	0.68	0.07	0.01	0.00	0.00	0.25	− 2.00
Exports							
Manufactures	0.41	0.29	0.06	0.04	0.01	0.19	1.35
Re-exports	0.60	0.08	0.10	0.01	0.00	0.21	1.70
Services	0.52	0.09	0.16	0.02	0.01	0.20	0.00
Energy (excluding natural gas)	0.11	0.08	0.02	0.64	0.06	0.10	3.00
Private investments							
Equipment	0.55	0.16	0.07	0.01	0.01	0.19	− 0.30
Non-residential buildings	0.58	0.17	0.05	0.01	0.00	0.18	− 1.20
Residential buildings (excluding transfer taxes)	0.58	0.17	0.05	0.01	0.00	0.18	− 1.20
Government							
Government sales	0.65	0.06	0.04	0.01	0.00	0.24	− 1.20
Benefits in kind	0.45	0.07	0.05	0.01	0.00	0.41	− 0.20
Intermediate deliveries	0.46	0.18	0.11	0.03	0.01	0.22	0.00

Price equations

Price domestically produced private consumption

$$\mathring{p}_c^{bh} = \left[1.0 - \left(\frac{C_{ag}+C_{wo}+C_{kg}}{C_{bh}}\right)_{-1}\right] \cdot \tag{A.36}$$

$$\left\{0.3\,\mathrm{g}_{18}(\mathring{p}_{mc}) + 0.7\mathring{k}_{cex} + 0.30\,\mathrm{g}_{20}\,(\Delta\ln(qy^{ms})) - \frac{0.35\ln}{fp}\left(\frac{p_{cex}^{bh}}{k_{cex}}\right)_{-1}\right\}$$

$$+\left(\frac{C_{ag}}{C_{bh}}\right)_{-1}\mathring{p}_{cag}^{bh} + \left(\frac{C_{wo}}{C_{bh}}\right)_{-1}\mathring{p}_{cwo}^{bh} + \left(\frac{C_{kg}}{C_{bh}}\right)_{-1}\mathring{p}_{ckg}^{bh}$$

where:

p_c^{bh} price of domestically produced private consumption (at basic prices)

p_{mc} price of imported consumer goods (excluding energy)

p_{cag}^{bh} price of natural gas consumption by households

p_{cwo}^{bh} price of consumption of residential services

p_{ckg}^{bh} price of private health care consumption

p_{cex}^{bh} price of 'free' consumption

k_{cex} costprice p_{cex}^{bh}

C_{bh} domestically produced private consumption

C_{ag} consumption of natural gas

C_{wo} consumption of residential services

C_{kg} private health care consumption

qy^{ms} rate of capacity utilisation market sector

Price domestically produced export of goods

$$\mathring{p}_{bfb}^{bh} = 0.35g_9(\mathring{p}_{bfc}) + 0.65\,\mathring{k}_{bfb} + 0.30\,\mathrm{g}_3\,\Delta\ln(qy^{vi}) - \frac{0.40}{fp}(\ln p_{bfb}^{bh} - \ln k_{bfb})_{-1} \tag{A.37}$$

where:

p_{bfb}^{bh} price of domestically produced exports of manufactures (at basic prices)

p_{bfb}^{bh*} long-term level of p_{bfb}^{bh}

k_{bfb} unit costs of domestically produced exports of manufactures

p_{bfc} price of competing exports (excluding energy), doubly weighted

qy^{vi} rate of capacity utilisation manufacturing industry

Price domestically produced investments

$$\mathring{p}^{bh}_{ibo} = 0.30\,g_{13}(\mathring{p}_{mi}) + 0.70\,\mathring{k}_{ibo} + 0.30\,g_{13}\,(\Delta\ln(qy^{ms})) - \frac{0.35}{fp}\ln\left(\frac{p^{bh}_{ibo}}{k_{ibo}}\right)_{-1} \tag{A.38}$$

$$\mathring{p}^{bh}_{ibb} = 0.35\,\mathring{k}_{ibb} + 0.30\,g_{13}\,(\Delta\ln(qy^{ms})) - \frac{0.60}{fp}\ln\left(\frac{p^{bh}_{ibb}}{k_{ib}}\right)_{-1} \tag{A.39}$$

$$\mathring{p}^{bh}_{iwx} = 0.35\,\mathring{k}_{iwx} + 0.30\,g_{13}(\Delta\ln(qy^{ms})) + 0.20\,g_{3k1}(\mathring{p}_{wh} - \mathring{p}_{iwx})_{-1} \tag{A.40}$$

$$-\frac{0,60}{fp}\ln\left(\frac{p^{bh}_{iwx}}{k_{iwx}}\right)_{-1}$$

where:

p^{bh}_{ibo} price of domestically produced investment in equipment

p^{bh}_{ibb} price of domestically produced investment in non-residential buildings

p^{bh}_{iwx} price of domestically produced investment in residential buildings (excluding transfer duty)

p_{mi} price of import investment goods

k_{ibo} unit costs of domestically produced investment in equipment

k_{ibb} unit costs of domestically produced investment in non-residential buildings

k_{iwx} unit costs of domestically produced investment in residential buildings

qy^{ms} rate of capacity utilisation market sector

p_{wh} price of existing houses

p_{iwx} final output price of investment in residential buildings (excluding transfer duty)

House prices

Long-term equation:

$$\ln(p^{*}_{hu}/p_{ci}) = 1.33\ln(LDA/p_{ci}) - 5.91(r_l - \mathring{p}_{ci}\cdot fp) + 0.71\ln\left(W^{g}_{nof}/p_{ci}\right) - 1.44\ln(wv) \tag{A.41}$$

Short-term equation:

$$(\mathring{p}_{hu}/p_{ci}) = 1.16\,g_6(\mathring{LDA} - \mathring{p}_{ci}) - 4.62\,g_{23}\,\Delta(r_l) + 1.54\,(\Delta\mathring{p}_{ci}\cdot fp) - 1.12\,\mathring{wv} \tag{A.42}$$

$$+0.14\,dum_2 - \frac{0.48}{fp}\ln\left(\frac{p_{hu}}{p^{*}_{hu}}\right)_{-1} + \frac{0,38}{fp}\left(bd * \ln\left(\frac{p_{hu}}{p^{*}_{hu}}\right)\right)_{-1}$$

where:

p_{hu} price of residential buildings

p^{*}_{hu} long-term level of the price of residential buildings

p_{ci} consumerprice index

LDA disposable labourincome

r_l long-term interest rate

W^g_{nof} nominal net other financial wealth of households

wv volume total dwelling stock (average)

dum_2 dummy for the year 2000 (2000=1; other years 0)

bd binaire dummy; if $\ln\left(\frac{p_{hu}}{p^*_{hu}}\right) > 0$ then $bd = 1$; else $bd = 0$

A.3 Labour market

A.3.1 Employment

Long-term equation:

$$\ln a^* = \ln(0.724y) - 0.32\ln(\frac{p_{le}}{cy}) - \ln d_l - v^*_l \tag{A.43}$$

Short-term equation:

$$\mathring{a} = 0.5\,\mathrm{g}_{21k1}(\mathring{y}) + \frac{0.33}{fp}[\ln \mathrm{g}_6(\frac{p_y}{c})] - 0.3(\mathring{p}_{le} - \mathring{cy}) - \frac{0.23}{fp}(\ln a - \ln a^*)_{-1} \tag{A.44}$$

where all variables refer to the market sector:

a employment (in labour years)

a^* long-term labour demand (labour years)

y gross value added

p_{le} labour costs in efficiency units

cy minimal cost per unit output (according to production function)

d_l working time of labour (hours per labour year)

p_y price of gross value added

c average cost price

p_{le} labour cost in efficiency units

A.3.2 Labour supply

$$\Delta as = \Delta ast + 0,2\,\mathrm{g}_{10k1}(\Delta a_p - \Delta ast) + 0,1[\mathrm{g}_{24k1}(\mathring{p}_{lb} - \mathring{p}_c - \mathring{twl})]ast \tag{A.45}$$

where:

as labour supply (in persons)

ast structural labour supply

a_p total employment (in persons)

p_{lb} gross wage rate in enterprise sector

p_c price of private consumption

twl wedge of employees' social security contributions and employees' direct taxes on wage income

A.3.3 Wages

Long-term equation:

$$\ln p_l^{ms*} = \ln p_y^{ms} + \ln h^{ms} + 0.19 \ln \Lambda + 7.02(u_{-fp}) \ln rp + 0.51 u_{-fp} \tag{A.46}$$

with

$$\Lambda = [1/(1-t_{wm})](1+t_{ww})(1+t_k) \tag{A.47}$$

Short-term equation:

$$\mathring{p}_{lc}^{ms} = \mathring{p}_y^{ms} + 0.34 \mathring{h}^{ms} + 0.70(\mathring{p}_{ci} - \mathring{p}_y^{ms}) + 0.11 t\mathring{w}m - 0.11 t\mathring{w}w + 0.22 r\mathring{p} \tag{A.48}$$

$$- 0.52(u - u_{-fp}) - \frac{0.40}{fp}(\ln p_l^{ms} - \ln p_l^{ms^*})_{-1}$$

$$\mathring{p}_{li}^{ms} = 0.23 \mathring{h}^{ms} - 0.04(u - u_{-fp}) + \frac{0.05}{fp} \tag{A.49}$$

where:

p_l^{ms}	wage rate, market sector
p_l^{ms*}	long-term wage rate, market sector
p_y^{ms}	price of gross value added, market sector
h^{ms}	labour productivity, market sector
Λ	wedge
rp	replacement rate
u	unemployment rate
t_{wm}	employees' tax and social security premium weight on wage income
t_{ww}	employees' social security premium weight on wage income
t_k	indirect tax rate
p_{lc}^{ms}	contractual wage rate, market sector
p_{ci}	consumer price index
twm	wedge variable relevant for employees: $1/(1-t_{wm})$
tww	wedge variable relevant for employers: $1+t_{ww}$
t_{wm}	employees' tax and social security premium weight on wage income
t_{ww}	employers' social security premium weight on wage income
p_{li}^{ms}	incidental wage rate, market sector

Appendix B Lag functions in SAFFIER

The main difference between the annual and the quarterly version of SAFFIER relates to the time lag functions, or "g-functions". The same g-functions are used in corresponding locations in both versions, but the meaning is different. In the tables below, the first column shows the number of the lag function in question, the second column shows the average lag, and the other columns show the weightings of the various quarters (table B1) and years (table B2).
In addition to the standard lag functions, the model also contains lagging functions derived from these. In general, *gikx* is a *gi* function delayed by *x* quarters.

Table B.1 Overview of lag function in the quarterly version in SAFFIER

Nr.	a.l.	Number of quarters[a]											
		0	1	2	3	4	5	6	7	8	9	10	11
g1	1	0.33	0.34	0.33									
g2	5.3	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
g3	2	0.20	0.20	0.20	0.20	0.20							
g4	2.2	0.25	0.20	0.20	0.15	0.05	0.05	0.05	0.05				
g5	2.3	0.10	0.20	0.30	0.20	0.10	0.10						
g6	1.3	0.30	0.30	0.20	0.20								
g7	0.4	0.60	0.40										
g8	0.7	0.50	0.33	0.17									
g9	1.5	0.13	0.37	0.37	0.13								
g10	1	0.40	0.30	0.20	0.10								
g11	5.1	0.03	0.06	0.09	0.12	0.14	0.14	0.12	0.10	0.08	0.06	0.04	0.02
g12	2.2	0.23	0.20	0.17	0.14	0.11	0.08	0.05	0.02				
g13	1.5	0.25	0.25	0.25	0.25								
g14	1.1	0.25	0.50	0.20	0.05								
g15	0.5	0.50	0.50										
g16	0.5	0.60	0.30	0.10									
g17	0.3	0.75	0.25										
g18	3.0	0.05	0.20	0.20	0.20	0.15	0.10	0.05	0.05				
g19	3.5	0.05	0.10	0.15	0.20	0.20	0.15	0.10	0.05				
g20	1.3	0.25	0.37	0.25	0.13								
g21	3	0.06	0.13	0.19	0.25	0.19	0.12	0.06					
g22	4.1	0.15	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.04	0.02
g23	2.5	0.15	0.20	0.20	0.15	0.15	0.10	0.05					
g24	7.5	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.06	0.06[a]
g25	4	0	0	0	0	0	1.00						
g25k4	0	1.00											
g26	4	0.10	0.12	0.12	0.12	0.12	0.12	0.10	0.10	0.05	0.05		
g28	3.5	0.12	0.13	0.12	0.13	0.12	0.13	0.12	0.13				
g34	2.9	0.28	0.20	0.12	0.08	0.06	0.05	0.04	0.04	0.04	0.04	0.03	0.02
g36	6.3	0.14	0.09	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05[b]

[a] The first column (Nr.) gives the lag function. The second column (a.l.) gives the lag function's average lag (in quarters), while the weights in the several lagged quarters are presented in the other columns.
[b] This lag function has also a weight of 0.06 in the twelfth up to and including the fifteenth lagged quarter.
[b] This lag function has also a weight of 0.05 in the twelfth up to and including the fifteenth lagged quarter..

When converting the time lags in quarters to time lags in years for variables which relate to year-end values, special mathematical rules have to be applied (see Broer [2005]). These are included in table B2 as *gs*.. lags.

Table B.2 Overview of lag functions in the yearly version in SAFFIER

Nr.	a.l.	Number of years				Nr.	a.l.	Number of years						
		0	1	2	3			0	1	2	3	4	5	6
g1	0.25	0.75	0.25			g14	0.3	0.74	0.26					
g1k1	0.5	0.50	0.50			g15	0.1	0.87	0.13					
g2	1.3	0.22	0.34	0.32	0.12	g15k1	0.4	0.63	0.37					
gs2	1.0	0.36	0.32	0.32		g15k2	0.6	0.37	0.63					
g2k1	1.6	0.13	0.35	0.32	0.20	g16	0.1	0.87	0.13					
g3	0.5	0.50	0.50			g17	0.1	0.94	0.06					
g3k1	0.75	0.30	0.65	0.05		g18	0.7	0.35	0.56	0.09				
g4	0.6	0.53	0.39	0.08		g19	0.9	0.25	0.63	0.12				
g4k2	1.0	0.18	0.62	0.19	0.01	g19k2	1.1	0.12	0.63	0.25				
g5	0.6	0.45	0.52	0.03		g20	0.3	0.69	0.31					
g5k1	0.8	0.25	0.67	0.08		g21	0.75	0.31	0.63	0.06				
g5k2	1.1	0.10	0.72	0.18		g21k1	1.0	0.16	0.69	0.15				
g6	0.3	0.67	0.33			g22	1.0	0.33	0.37	0.25	0.05			
g6k1	0.6	0.43	0.57			g22k1	1.3	0.21	0.41	0.28	0.10			
g7	0.1	0.90	0.10			g22k2	1.5	0.11	0.42	0.31	0.15			
g8	0.2	0.83	0.17			gs22	0.7	0.49	0.32	0.19				
g9	0.4	0.63	0.37			gs22k2	1.0	0.28	0.38	0.21	0.06			
g9k1	0.6	0.37	0.63			gs22k4	0.7	0.49	0.32	0.19				
g10	0.25	0.75	0.25			g23	0.6	0.44	0.51	0.05				
g10k1	0.5	0.50	0.50			g24	1.9	0.15	0.25	0.27	0.24	0.09		
g11	1.3	0.15	0.48	0.32	0.05	g24k1	2.1	0.09	0.24	0.27	0.25	0.15		
g11k2	1.8	0.03	0.34	0.46	0.17	g24k2	2.4	0.04	0.23	0.27	0.25	0.20	0.01	
g12	0.6	0.50	0.44	0.06		g25	0	1.00						
g12k1	0.8	0.32	0.56	0.12		g25k4	1	0	1.00					
gs12	0.3	0.74	0.26			g26	1.0	0.28	0.47	0.24	0.01			
g13	0.4	0.63	0.37			g28	0.9	0.31	0.50	0.19				
g13k1	0.6	0.37	0.63			g28k1	1.1	0.19	0.50	0.31				
g13k2	0.9	0.19	0.75	0.06		g34	0.7	0.50	0.30	0.20				
g13k3	1.1	0.06	0.75	0.19		g36	1.5	0.25	0.25	0.25	0.25			
gs13k2	0.5	0.50	0.50											

Appendix C Regime dummies and parameters

SAFFIER is a model which can be used for various purposes. To enhance the flexibility in model use, various regime dummies and parameters have been built in. By changing one or more of these dummies or parameters, it is relatively easy to make a different model version. Most dummies are aimed at incorporating changes in the institutional structure into the model (in the area of linkages and indexations, for instance). The aim of the other dummies is to facilitate the calculation of stable long-term growth paths with SAFFIER.
The table below provides an overview of the incorporated dummies and parameters. The table also shows their values in the version of SAFFIER used to make the standard calculations for the short term (1-2 years) and the medium term (4-8 years), such as the standard variants presented in chapter 5.

Public sector dummies

Two dummies decide on the linkage between contractual wage trends in the health service and the civil service as well as benefit levels to contractual wage trends in the market sector. In principle these linkages apply, but for the purposes of calculating specific policy variants they can be switched off for specific periods. The indexation of child allowance to inflation can also be switched off by means of a dummy.
A second set of dummies relates to tax rates. In the current system of different tax brackets and tax rates, the average tax burden rises through the operation of the progression factor. In long-term calculations the tax burden would thus rise indefinitely. In order to obtain stable growth paths, it is necessary to switch off the operation of the progression factor and to calculate with a constant tax burden. The short- and medium-term calculations do take account of the current tax system and the progression factor, however.
To run variants in which the EMU balance does not change (the balanced budget variants), seven dummies are available, one for each tax type. These ensure that these tax types are calculated endogenously, so that the EMU balance comes out unchanged over a certain time horizon or to achieve a certain objective. These dummies are used in the preparation of central paths, for instance, to ensure that in the technical central path the EMU balance gradually moves towards nil. Over the shorter term, only payroll and income tax rates are adjusted, but over the longer term other tax types can play a role in the realisation of this objective. Normal central paths and variants use an endogenous EMU balance.
In addition to these dummies, a dummy is available to select the relative increase in public debt rather than the EMU balance as the target value. This may be necessary to achieve a stable growth path over the long term.

Other dummies

In the standard version of SAFFIER, the natural gas price is linked to the oil price. For specific variants this linkage can be switched off, however, with the help of CAGBNK__. With the dummy UWWBN___E it is possible to impose the same change on the number of unemployed and the number of unemployment benefit payments, which may not necessarily be the case over the short or medium term, but which is essential for the calculation of stable growth paths. And finally, there are two dummies which ensure that over the long term the volume trends for domestically-produced exports and re-exports move in line with the general real growth rate.

Table C.1 Regime-dummies and parameters in SAFFIER

SAFFIER variable name	Meaning	Regime in standard version
'Collective sector'-dummies		
LC_BN___	Link between contractual wage rate in government and health care sector and that in the market sector	on
LMWBN___	Link between the minimum wage rate and the average contractual wage rate	on
OYKBN___	Indexation of child allowances to inflation	on
T..BN___E	Operation progression factor in tax system	on
T..FN4..A	Target for EMU balance	off
T__BN__A	Target for government gross debt	off
Other dummies		
CAGBNK___	Link between consumers' gas price to oil price	on
UWWBN___E	Same change in nunmber of unemployment benefit payments and number of unemployed people	off
BFBBNE__	Switch off trend-term in equation for domestically produced exports	off
MWPBN___	Switch off trend-term in equation for re-exports	off
Parameters		
P_WHPBN	House prices short-term: mainly demand-factors; alternative is cost price oriented	on
P_WHPBNE	House prices long-term: mainly demand-factors; alternative is cost price oriented	on

Parameters

Switching to another regime can also be achieved in the model by giving a parameter a different value. In that case, the regime will not change for a specific period of years, but for a specific application. This option is used in the house price equation. The model contains two parameters in this context, which allow a change of regime for short-term developments (P_WHPBN) and long-term developments (P_WHPBNE). In the standard version of SAFFIER, the development of house prices is determined by various supply and demand factors, such as household real disposable income, household financial wealth, real interest rates and the housing stock. This may lead to a situation where house prices move differently from the average price level. Over the long term this is unsustainable, however. To ensure that in the calculation of stable growth

paths house prices move in line with the average price level, the estimated house price equation can be replaced with an equation in which over the long term house prices move in line with the prices of newly-constructed homes.

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