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SAFE

A quarterly model of the Dutch economy for short-term analyses

CPB Netherlands Bureau for Economic Policy Analysis
Van Stolkweg 14
P.O. Box 80510
2508 GM The Hague, the Netherlands

Telephone +31 70 338 33 80
Telefax +31 70 338 33 50
Internet www.cpb.nl

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Abstract in English

SAFE is the name of a large-scale macro econometric quarterly model used by CPB Netherlands Bureau for Economic Policy Analysis in preparing short-term forecasts and analyses of the Dutch economy. This document gives a comprehensive description of the SAFE model. The description of the model's equations and results concerns the model version used since the preparation of the Macroeconomic Outlook 2003. In order to explain the working of the model, the results from a number of standard shocks and scenarios are presented.

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Preface

In the course of 1999, CPB introduced the SAFE model for its short-term analyses. This publication gives a broad description of the current version of SAFE.

A model of the Dutch economy is never finished, if for no other reason than that the validity of the necessary simplifications is often time-related and new data sometimes lead to modifications. Any publication of a large-scale econometric model will therefore have a limited shelf life and merely reflect the situation at a given moment in time. Having said that, we do wish to meet the transparency requirement that the current version of the tools and instruments CPB uses be made available to the public. In order to meet this requirement, the most recent version of the model will be published on CPB's Internet site (http://www.cpb.nl) whenever significant modifications are made to the model. Wherever possible, links will direct interested readers to background documents available on the Internet. In this light, this publication may be considered as a kind of baseline memorandum. As with trees, the number of branches is bound to grow in the future, resulting in a continuously updated description of the model that is easily accessible and complete.

The SAFE quarterly model was built on the foundations of its predecessors with such illustrious names as FKSEC (1992) and KOMPAS (1983). It follows that we cannot tell exactly who the current or former CPB employees are who contributed directly or indirectly to the making of SAFE. This document was drawn up by Bart Borsboom, Henk Kranendonk, Barthold Kuipers, Martin Mellens, Johan Verbruggen and Paul Westra of the Cyclical Analysis Unit. In addition, Erika Aarnoutse and Berend Hasselman made significant contributions to the layout.

F.J.H. Don
Director, CPB

1 Introduction

This document explains the working of the SAFE econometric model that CPB uses for making short-term analyses. The description of the model's equations and outcomes in this document concerns the SAFE model version used in the preparation of the Macroeconomic Outlook (MEV) 2003.

This introductory chapter deals firstly with the background of the model, and provides an answer to the question of why CPB, when making short-term projections, uses a large-scale econometric model (section 1.1). This introductory chapter also contains a broad description of the model (section 1.2) and deals with a number of model specification aspects (section 1.3). Chapter 2 describes the main behavioural and institutional equations. For the sake of clarity, this description is confined to the main features. Detailed econometric information may be found in the underlying memoranda, most of which are available on the CPB Internet site. The links concerned are included in the bibliography. Lastly, chapter 3 explains the working of the model based on a number of shocks and scenarios.

1.1 Backgrounds

CPB has been using a new macro model called SAFE since mid-1999. SAFE stands for Short-term Analyses and Forecasts for the Dutch Economy. CPB uses this model for forecasts and policy analyses in the short term, more specifically in the preparation of the Central Economic Plan, the Macroeconomic Outlook and the forecasts that are published every quarter in the CPB Report. SAFE is the most recent of the quarterly models used for short-term analyses by CPB since the early 1970s, and is the successor to FKSEC[1]. For medium to long-term analyses, such as calculating the effects of election programmes and the Coalition Agreement, CPB currently uses the yearly model JADE.[2]

When SAFE was developed, the causal relationships between the economic variables as modelled in JADE were used as assumptions as much as possible. Since the first model version of SAFE, various equations of the model have been adapted. In many instances, this led to modifications to JADE as well, which recently also underwent various modifications for other reasons. These modifications to the SAFE and JADE models have meant that the disparities between them have gradually diminished, to the point where they now show considerable similarities. For the main variables, the two models contain equations for both the short and the long term and make abundant use of what is known as the error correction model (see section 1.3.4). The time horizon of the projections and analyses for which SAFE is used in

[1] See CPB (1992). For a brief overview and description of the other models used by CPB, reference is made to CPB (1998).

[2] See CPB (2003) for a current description of the JADE model.

practice is limited to about three years, however. Owing to the short-term nature of the SAFE analyses, this model, unlike JADE, has to be able to describe cyclical developments taking place within a year. As a result, the modelling of time lags is more complex in the quarterly SAFE model than it is in the yearly JADE model.

Projections can be made in numerous ways. They can be made with or without models. If the preferred option is to use a model, a broad selection is available varying from large-scale econometric models to so-called (vector) ARIMA models, as well as all kinds of intermediate forms.[3] Although CPB's short-term projections are not directly derived from SAFE, this large-scale econometric model does constitute the basic instrument for them. The choice to make use of such a model is prompted by the fact that only projections that are based on a large-scale econometric model can accommodate the requirements set by users of CPB's short-term projections, enabling them to use them judiciously in the preparation of economic policy. What are these requirements? Firstly, the projections should be clear conceptually and consistent from an accounting point of view. In practice, this means that the projections should be in line with the data and definitions of the National Accounts. Secondly, the projections should provide an understanding of a large number of variables in which politicians, and other actors engaged in economic policy formulation, are interested. Thirdly, it should be possible in a consistent manner to add uncertainty simulations to supplement projections. The object of these simulations could be to illustrate the margin of uncertainty affecting a projection, but could also serve to illustrate the economic effects of policy proposals in the short term. Lastly, it is of great importance that CPB is able to account for and explain the projections themselves and the differences with earlier projections in economic terms, which make it essential that the assumed economic relationships and exogenous variables used be clarified. Without a model such as SAFE, CPB would be unable to prepare projections that meet the above requirements.[4]

The explicit formulation and quantification of the assumed equations and exogenous variables make it possible to discuss, verify and reproduce the economic analysis. This is not to say that the full extent of all relationships between the economic variables is included in the model. For relationships affecting sub-areas, such as social security, government finances and the energy market, for which the CPB has detailed sub-models available, SAFE only incorporates simplified equations known as rules of thumb. The sub-models concerned are too large to be included in SAFE. The outcomes of these individual sub-models are used for making projections, however. This is done by imposing, as it were, the results of the analyses of the specialists concerned upon the macro-model (via autonomous variables or via targeting certain variables). Specialists use

[3] See Don (2001a) for a review of the various types of models based on a number of criteria a good forecast has to meet.

[4] See also Donders and Lunsing (1999).

the outcomes of SAFE as input for their analyses and, by imposing the results of the sub-models, are able to change this input to some extent, so that when making the projection an iterative process is taking place between the macro-model and the sub-models. After completing one or two of these iteration procedures, the differences between the outcomes of the macro-model and the sub-models are so minor in most cases that no subsequent iteration exercise is required.

Since SAFE does include simple equations (known as rules of thumb) for the endogenous variables, it is frequently not necessary to go through a similar iterative procedure for the purpose of computing simulations as well.

1.2 A bird's-eye view of SAFE

Broadly speaking, SAFE is made up of three large parts or blocks, namely the market for goods and services, the labour market and the general government. The large-scale econometric macro-models CPB used prior to FKSEC incorporated a comprehensive monetary block as well. This block was discontinued, however, in view of the monetary policy directed (until the advent of the euro) at maintaining a fixed rate of exchange between the guilder and the Deutsch mark. Dutch interest rates were accordingly shadowing German rates, and comprehensive modelling of supply and demand in money and capital markets only produced limited value added.

The part that describes the market for goods and services contains behavioural equations for the endogenous components of final demand (private consumption, investment and export). Together with government spending, largely dealt with exogenously, these expenditure categories constitute the final demand for goods and services. In modelling private consumption, a distinction has been made between households with access to capital markets and that are deemed to behave in accordance with the life-cycle theory on the one hand, and households without access to capital markets that are deemed to consume their disposable income in full on the other. Business investment (excluding housing and stocks) are a special expenditure category because it not only forms part of final demand but also plays a significant part in capacity creation on the supply side of the economy. In modelling goods export, the current version of SAFE distinguishes for the first time between domestically produced exports and reexports. The reasons are that there has been a structural change in the share of both components in the total export of goods, and that the explanatory variables as well as the economic effects of the two components differ substantially.

In the short term, production in the market sector is determined by the demand for goods and services. Part of the final demand originates abroad, the balance being met domestically. Which part originates from abroad depends in part on the price ratio between domestically produced output 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 factors of production. Whenever

the demand for goods and services is at variance with what can be produced at normal rates of capacity utilisation, the economy experiences tension. In the goods and services market, this tension affects the capacity utilisation rate, being one of the explanatory selling price variables. Selling prices are additionally determined by cost factors and the price of competitors. Since selling prices depend on the capacity utilisation rate, in the long term output will be equal to potential output.

In the labour market, the demand for labour or employment results directly from the production function. Employment is determined by the volume of production, the relative cost of labour, working hours and advances in labour-saving techniques. The supply of labour is largely determined by trends such as demographic developments. Tension in the labour market (the discouraged-worker-effect) and fluctuations in real disposable wages play a part, too. While unemployment is the difference between the supply of labour and employment, it affects the supply of labour and - via wages - employment at the same time.

A right-to-manage model is used as a basis for explaining the wage rate in the market sector, where the wage rate is the outcome of negotiations between employers and employees. Aside from fluctuations in the rate of inflation and labour productivity, the wage rate depends on the fallback position of dismissed workers, which is determined by the wedge, the replacement rate and the unemployment rate. An improvement in this fallback position pushes up the wage rate. The effect of the unemployment rate on wage developments suggests that, in the long term, the labour market tends towards a situation of equilibrium.

The rate of capacity utilisation and the rate of unemployment are the traditional tension indicators of the goods and services and labour markets respectively. In addition, the so-called output gap has been in vogue for some time as tension indicator of the economy as a whole. This output gap can be calculated with the current model version of SAFE. The output gap is equal to the difference between actual and potential production (in volume terms) expressed as a percentage of potential production. Potential production is the sustainable level of output that can be achieved given the production structure, the state of technology and the available factors of production. The sustainable level of input of the labour factor of production is determined in part by the non-accelerating inflation rate of unemployment, known as the NAIRU.

The NAIRU is the level of unemployment that results after adjustments for one-off and cyclical factors. The economic adjustment processes also move towards this level of unemployment. The NAIRU level depends on the wedge, the replacement rate, and the relative capital costs.

SAFE’s potential production, output gap and the NAIRU are currently all still modelled as ‘lose end’, meaning that they do not play a part as explanatory variables in other model equations. The only exception to this is the output gap, which plays a role in determining the structural general government financial balance. In the current model version, this means that the

unemployment rate itself, rather than the variance between it and the NAIRU, plays a role as tension indicator in the wage equation, and that the capacity utilisation rate, or the change in it, functions as tension indicator for determining price developments, among other things. Whether adding the output gap and the NAIRU to, or substituting these for the traditional tension indicators would produce improvements in an empirical and theoretical sense, still needs to be investigated.

The general government comprises the government and the system of social security. The revenue and expenditure of both sectors have been modelled in SAFE. Most equations reflect institutional regulations and hence not behaviour. A non-endogenous approach to behaviour in the general government was deliberately chosen to be better able to analyse the consequences of policies or alternative policies. This also applies to the health care sector, which strictly speaking forms part of the corporate sector and not the general government.

1.3 Model specification

1.3.1 Scope

SAFE consists of 1920 equations. Only 32 of these are estimated or calibrated behavioural equations, i.e. 20 behavioural equations for modelling the expenditure categories, import and production capacity, 5 price equations and 7 behavioural equations for modelling the labour market. In addition, the model contains 195 rules of thumb relating, among other things, to institution-driven equations, depreciation and household wealth. By far the most (1693) equations in the model consist of so-called identities. These are mostly technical equations (for instance to determine the absolute or percentage change from the level of the current and the previous quarter) definition equations (for instance to determine total employment by aggregating the individual employment components) and especially many contribution equations, to simplify the analysis of outcomes.[5] In total, SAFE consists of 2337 variables. In addition to the 1920 endogenous variables, the model has 198 exogenous and 219 autonomous variables.

1.3.2 Exogenous variables

Exogenous variables are ones that are not determined in the model by means of an equation. Appendix A lists the exogenous variables that occur in SAFE. To make a model projection it is necessary to make a projection of all these international and domestic variables. As said earlier, this is done by a number of specialist CPB units, using detailed computing models in some

[5] In a contribution equation, the contribution of the variable in question to the change in the explanatory variable is calculated per individual explanatory variable.

cases. Domestic exogenous variables relate for the most part to government policy assumptions. Apart from this, there are domestic exogenous variables in such fields as social security, energy, labour market, interest rates, labour-saving technical progress, specific investment categories, consumption of residential services, share prices, housing prices and the cumulative cost base. The model also includes what are known as regime dummies that enable it to exclude or include the effect of specific interlinked mechanisms, such as those between developments in civil service and related sector wages and developments in market sector wages. Appendix B lists the regime dummies that occur in SAFE as well as their values. In all but a few cases, these involve government-controlled mechanisms. Whether a specific mechanism, interlinked or otherwise, has been included or excluded in the model can have a considerable impact, especially when computing simulations.

In addition to domestic exogenous variables, the model also includes various international exogenous variables. For an open economy such as that of the Netherlands, developments abroad are of crucial importance. A great deal of time is accordingly devoted to estimating the exogenous variables of other countries. This takes place in conjunction with the projections of international organisations (OECD, EC and IMF) and of national institutions in leading countries, such as Germany and the United States.

1.3.3 Lags

Many behavioural equations in the model contain lagged variables. Apart from discrete time lags, mostly of one quarter, there are many distributed lags, too. In the model, these lags are marked by means of lag functions. A list of the lag functions used and their average lags is included in Appendix C.

1.3.4 Error correction model

Before a start can be made on estimating equations, the required specification should first be defined. This begs the question of whether equations should be formulated in levels or in changes, expressed in percentages or otherwise.[6] Research by Engle, Granger and others has contributed significantly to resolving this problem. These researchers suggested a two-tier procedure that has been repeatedly applied in SAFE.[7] This procedure starts with a estimated level equation for the long-term relation, followed by an equation in percentage changes for the short-term dynamics. The short-term equation includes what is known as an error correction term that may be regarded as the difference between the actual and the long-term equilibrium

[6] Protagonists of change equations point to the danger of spurious correlation when estimating in terms of levels, whereas protagonists of level equations argue that change equations are generally not able adequately to reflect the long-term relationships based on economic theory. See for instance ten Cate and Draper (1989).

[7] See Engel and Granger (1987) in particular. For the econometric backgrounds to this procedure, see, amongst others, Charemza and Deadman (1992) and Hendry (1995).

level of the dependable variable in the previous period. Whenever the actual level is below (or above) the equilibrium level, this deviation or 'error' will be partially corrected in the subsequent period, because the error correction variable has an upward (or downward) effect on the percentage changes in the variable concerned. The error correction variable is equal to the residual of the long-term equation. In econometric jargon, this kind of specification is referred to as ECM: Error Correction Model.

The related long-term equation looks as follows:

$$y^* = \alpha_1 x + c \tag{1.1}$$

where:

y^* long-term value of dependent variable

x explanatory variable(s)

c constant

The short-term equation reads as follows:

$$\mathring{y} = \alpha_2 \mathring{x} - \varepsilon[(y - y^*)/y]_{-1} \tag{1.2}$$

where:

y actual value of dependent variable

The error correction parameter ε indicates the speed at which the actual level of the dependable variable adjusts itself to its long-term value. The closer ε is to zero (unity), the longer (shorter) this adjustment process will take. In practice, the long-term equation is often estimated in natural logarithms (ln). In that event, the error correction variable is specified as follows: $\ln(y/y^*)_{-1}$. This specification method is also applied in SAFE in virtually all cases.

The equations (1.1) and (1.2) can also be estimated dynamically, the short-term and long-term equations being estimated in a single step by substituting (1.1) for (1.2). Various specifications were used when estimating the SAFE behavioural equations. In most cases, the two-tier procedure of Engle and Granger was applied, but some equations were assessed dynamically, or still without ECM.

1.3.5 Notation

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[8] or ratios. Prices are indicated by means of the letter p, followed by a subscript

[8] Strictly speaking, the model differentiates between three kinds of volumes, namely in terms of the previous year's prices, previous quarter's prices and the prices of a fixed basic year. For the sake of simplicity, the description of the equations in

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 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.

this memorandum makes use of lower case letters for all three kinds of volumes.

2 The equations of the model

2.1 Introduction

This section describes the main behavioural and institutional equations, using earlier FKSEC and JADE[9] model descriptions. New parts of the model, such as the modelling of potential growth, output gap, reexports and domestically produced exports are described in more detail than the unchanged parts.

The model description is organised in five parts, namely the goods and services market (section 2.2), the labour market (section 2.3), the tension in the economy (section 2.4), the public sector (section 2.5) and all other variables (section 2.6), in that order. Because the manner in which the tension in the economy has been modelled is a relatively new SAFE element, attention is devoted to the modelling of potential growth, the output gap and the NAIRU in a separate section. The section dealing with other variables (2.6) covers the following model parts: the balance of payments, savings, income categories, labour share in enterprise income, wealth components and depreciation.

2.2 The market for goods and services

The description of the goods and services market starts with the supply of goods and services, or output capacity (section 2.2.1). The individual spending categories, namely private consumption (section 2.2.2), export (section 2.2.3) and investment (section 2.2.4) are then discussed. These spending categories together make up the demand for goods and services. This demand can be met partly by domestic production, but some of it is satisfied via imports (section 2.2.5) from abroad. The last item to be discussed is pricing (section 2.2.6).

2.2.1 Supply of goods and services and output capacity

Initially, the development of SAFE did not provide for any production function. The modelling opted for at the time was one whereby output capacity lagged some way behind actual production. In this way, a capacity utilisation rate variable (*qy*) was built that reflected the tension in the goods and services market. This capacity utilisation rate still plays a part in the current model version, notably in the price and export equations. In recent years, however, attention has tended to focus increasingly on the output gap as a means of measuring the tension in the economy (see section 2.4). CPB calculates the output gap on the basis of a specific production function.[10] This production function was recently incorporated into SAFE as well.

[9] See CPB (1992) and CPB (2003).

[10] See Draper et al. (2001) for a more detailed explanation of the production function. See also Don (2001b).

For SAFE, the choice fell on a CES production function, with labour and capital as factors of production. The quantity of labour is expressed in units of efficiency because over time, a fixed quantity of labour produces more every year owing to advances in labour-saving techniques.[11] Account is also taken of changes in the average number of hours a full-timer works per year. The operating time of capital has been set as constant and technological progress of capital has been set at zero.[12] In simplified form, the production function for the market sector looks as follows:

$$y = [\lambda^{\frac{1}{\sigma}} a_e^{\frac{\sigma-1}{\sigma}} + (1-\lambda)^{\frac{1}{\sigma}} k^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{2.1}$$

with

$$a_e = a d_l e^{v_l^*} \tag{2.2}$$

where all variables refer to the market sector:

y	gross value added
a_e	labour input in efficiency units
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

As a logarithmic function, the optimum input of labour and capital, or the long-term demand for labour and capital, looks as follows:[13]

$$\ln a^* = \ln\lambda + \ln y - \sigma \ln\left(\frac{p_{le}}{cy}\right) - v_l^* - \ln d_l \tag{2.3}$$

$$\ln k^* = \ln(1-\lambda) + \ln y - \sigma \ln\left(\frac{p_k}{cy}\right) \tag{2.4}$$

[11] 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. See also section 2.3.1.

[12] This hypothesis has been tested empirically in Draper et al. (2001) and is not rejected.

[13] 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. Also see section 2.4.2.

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 demand equations referred to above are projections using the following values for the parameters as result:[14] $\lambda = 0.72$ and $\sigma = 0.32$. Apart from actual production, the optimum input of labour and capital therefore depends above all on the relative cost of labour (p_{le}/cy) and cost of capital (p_k/cy). respectively. Based on the production function, the minimal costs may be calculated as:

$$cy = [\lambda\, p_{le}^{1-\sigma} + (1-\lambda)\, p_k^{1-\sigma}]^{\frac{\sigma}{\sigma-1}} \tag{2.5}$$

with:

$$p_{le} = \frac{p_l}{d_l \mathrm{e}^{v_l^*}} \tag{2.6}$$

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

p_l wage rate

p_k capital costs

Capital costs are defined as a function of the effective investment price, depreciation rate and real rate of interest after taxes.[15] The relative labour costs (p_{le}/cy) and relative capital costs (p_k/cy), which play a major part in the demand for the factors of production, can then be calculated as well.

Market sector production capacity can be calculated using equation 2.1 as a basis.[16] The market sector's capacity utilisation rate (q^{ms}) is defined as the quotient of actual production and production capacity. This capacity utilisation rate plays an important role in determining the output gap (see section 2.4). As said earlier, the original capacity utilisation rate (qy^{ms}), which is calculated as a function of the time lag in production, is still important for the rest of the model (notably in the price and export equations). Whether the 'old' capacity utilisation rate (qy^{ms})

[14] See Draper et al. (2001).

[15] See Appendix A of Draper et al. (2001).

[16] For the other sectors, it is assumed that production capacity is equal to actual production.

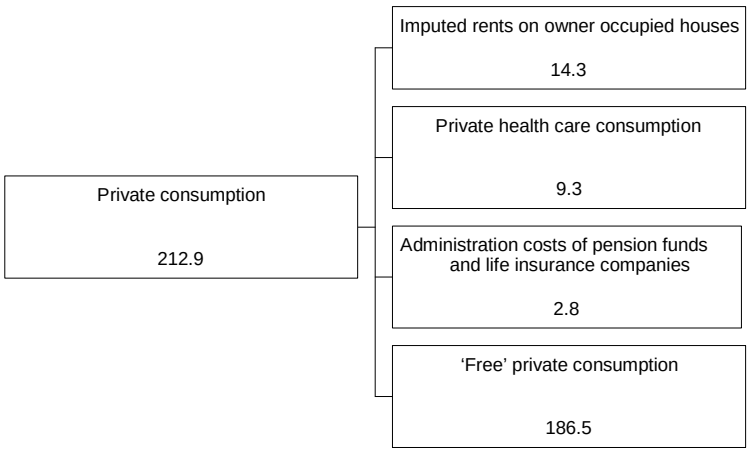
should be replaced by the 'new' capacity utilisation rate (q^{ms}) or the output gap must still be investigated.

In addition to the long-term equations of the demand for labour (2.3) and capital (2.4), separate short-term equations of the demand for these factors of production have been estimated as well. The results, and the manner in which the demand for capital (and the resultant investments) and for labour have been modelled in SAFE, are explained in more detail in subsections 2.3.1 and 2.2.4.2 respectively.

2.2.2 Private consumption

If the volume of private consumption increases by 1%, it would result, all things being equal, in an increase in GDP of some 0.35%. When considered in that light, private consumption is the principal spending category. While it is true that the goods and services category measured in euro's is larger, it has a greater impact on imports, so that relatively speaking its significance in terms of GDP is somewhat smaller. In modelling private consumption, account is taken of the fact that in three consumption categories, consumers have no, or hardly any, freedom of choice. These three categories (imputed rents on owner occupied houses, privately financed consumption of health care and the administration costs of pension funds and life insurance companies) are determined based on exogenous variables and then added, by definition, to the other consumption, hereafter referred as 'free' consumption.[17]

Figure 2.1 Composition of private consumption in SAFE (billion euro's, 2001)



For 'free' private consumption, SAFE incorporates separate equations for the long and the short

[17] See Okker and den Haan (1987).

term. Long-term modelling distinguishes two types of household. The first has access to the capital market and behaves in accordance with the life-cycle theory when it comes to consumption. This implies that decisions involving labour supply and investment are taken before decisions regarding consumption, so that lifetime wealth is exogenous when taking consumption decisions.[18] Households have a finite life, with a constant death hazard rate of λ. The purpose of savings is to distribute consumption evenly over time, the intertemporal substitution elasticity rate ε and the time preference rate β being constant. Three income sources are differentiated. These are households' disposable wage income[19], disposable benefit income, and disposable profit income. The last-named income category depends on the returns achieved on the financial wealth of households (*Wg*). The following long-term equation may be drawn for the 'free' consumption of households with access to the capital market:

$$C_{vr}^{k*} = [\varepsilon(\beta+\lambda)+(1-\varepsilon)(r_{\ell n}-\mathring{p}_c^e+\lambda)]\left(Wg_{-1}+\frac{LDA_k+ODA_k}{r_{\ell n}-\mathring{p}_{ln}^e+\theta}\right) \tag{2.7}$$

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: $r_{ln} = (1-tll-psl)r_l$
r_l	long-term interest rate
tll	rate of direct taxes paid by labour
psl	social security contribution rate for employees
p_c^e	expected price of 'free' private consumption[20]
Wg	net wealth of households (excluding pension rights)
LDA_k	disposable households' wage income (see note 19)
ODA_k	disposable benefit income, excluding transfers related to medical expenses
p_{ln}^e	expected net wage rate[21]

The parameter θ stands for the sum of the death hazard rate, the rise in wages the subjects expect to achieve in their lifetime, and a risk premium.

This equation suggests that the consumption of households with access to the capital market is determined by the sum of the financial wealth of household, the present value of the lifetime wealth of these households and the long-term value of the marginal lifetime wealth propensity to consume. Apart from the dependence of this marginal propensity on a number of constant parameters, such as intertemporal substitution elasticity, the time preference rate and the death

[18] For more details on the theoretical concept behind consumption equation, see CPB (1997) and CPB (2003).

[19] Including the imputed disposable wage income of the self-employed and excluding privately funded health care consumption and the administration costs of pension funds and life insurance companies.

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

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

hazard rate, it also increases in response to a rise in the real long-term interest rate net of taxes. The discount rate used is equal to: $r_{\ell n} - \mathring{p}^{e}_{ln} + \theta$.

Households without access to the capital market consume their entire disposable income. Their incomes amount to a fraction ϕ_l of total disposable wage income and a fraction ϕ_u of total disposable benefit income. These households have no profit income. This means that the long-term equation for the 'free' consumption of all households looks as follows:

$$C^{*}_{vr} = \{\varepsilon(\beta+\lambda) + (1-\varepsilon)(r_{\ell n} - \mathring{p}^{e}_{c} + \lambda)\}\left(Wg_{-1} + \frac{(1-\varphi_{\ell})LDA_k + (1-\phi_u)ODA_k}{r_{\ell n} - \mathring{p}^{e}_{ln} + \theta}\right) + \varphi_{\ell} LDA_k + \varphi_u ODA_k \quad (2.8)$$

where:

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

Table 2.1 gives the parameter values of the estimated long-term equation.[22] This set of parameter values suggests that the long-term value of the marginal lifetime wealth propensity to consume currently amounts to 0.038. Based on the estimated parameter values, the discount rate that households use when reducing the expected wage and benefit income to its present value currently amounts to some 25%. This discount rate suggests that the time horizon of households with access to the capital market is rather short, i.e. approximately four years.

Table 2.1 Estimated parameters of SAFE's long-term consumption equation

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

Private consumption growth in the short term is modelled as follows:

$$\mathring{c}_{vr} = 0.55\frac{g_6(\Delta lda_k)}{(C_{vr})_{-1}} + 0.69\frac{g_{16}(\Delta oda_k)}{(C_{vr})_{-1}} + 0.37\frac{\Delta zda_k}{(C_{vr})_{-1}} - 0.60\Delta r_{\ln} + 0.035\frac{g_{15}(\Delta hw)}{(C_{vr})_{-1}} + \frac{0.046}{4}\left(\frac{g_{13}(\Delta w^{h}_{-2})}{(C_{vr})_{-1}}\right) + \frac{0.033}{4}\left(\frac{g_{13}(\Delta w^{a}_{-2})}{(C_{vr})_{-1}}\right) + \frac{0.054}{4}\left(\frac{g_{13}(\Delta w^{r}_{-2})}{(C_{vr})_{-1}}\right) - \frac{0.15}{4}\ln\left(\frac{c_{vr}}{c^{*}_{vr}}\right)_{-1} \quad (2.9)$$

where:

c_{vr} 'free' private consumption

zda_k disposable households' profit income, excluding cwe and c_a

[22] See Kranendonk and Verbruggen (2002) for a more detailed description of the estimated result of the long-term and short-term consumption equation.

cwe	imputed rents on owner occupied houses
c_a	administration costs of pensionfunds and life-insurance companies
w^h	stock of residential dwellings owned by households
w^a	stock of shares owned by households
w^r	other assets of households (total households' assets minus mortgages and other debts)
hw	revaluation of stock of residential dwellings

In the first place, short-term growth in consumption is determined by increases in real disposable income. The extent to which consumption responds to an increase in income – the marginal propensity to consume – depends on the kind of income. As is to be expected, the marginal propensity to consume of benefit income recipients is greater than that of wage earners. Since benefit income recipients have less to spend, they will consume a greater portion of any increase in their income. Similarly, it is logical that consumption will be least responsive to profit income or investment income.

In the short-term equation, an increase in wealth affects consumption, too. Consumption is least responsive to the stock of shares and most responsive to the remaining capital, with the stock of ownership of dwellings fitting in between these two.[23] Empirical results are in line with the assumption that the greater the volatility of a wealth component, the lower will be the marginal propensity to consume.[24] Consumers perceive an increase in their savings as more certain than an increase in their stock of shares. Consumption growth not only depends on the growth in the stock of ownership of dwellings but also on the change in the growth rate (Δhw). The idea behind this is that a higher rise in home prices will result in higher home price rises in the future as well. If price rises are lower than the year before, they will be perceived as a setback, even if these price rises are, in themselves, a positive development. For more information on how the various wealth variables are determined in SAFE, reference is made to section 2.6.4.

2.2.3 Export of goods and services

Owing to the open character of the Dutch economy, economic growth in the Netherlands is largely determined by export growth. All things being equal, an increase of 1% in the volume of exports results in a rise in GDP of some 0.3%.

In 2000, the export of goods and services was made up of 83% goods and 17% services. Goods exports are sub-divided into manufacturing and energy. Developments in both volume

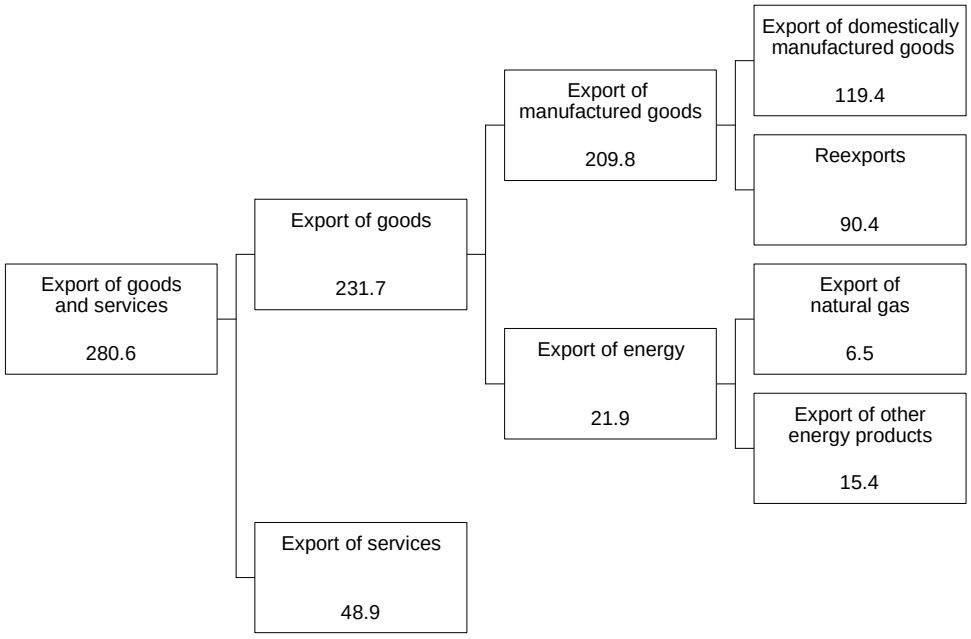
[23] We are concerned here with wealth values at the end of the quarter. The factor 4 has been added owing to the stock nature of the wealth variables.

[24] The developments in share prices and the spread in the stock of shares held by households varied substantially at the start of this century from the situation in the sampling period of the short-term equation (1972-1999). This is why, when preparing the projection for the 2003 Macroeconomic Outlook, account was taken of a stronger and more rapid effect on consumption resulting from developments in the stock of shares held by households.

and price of energy, sub-divided into natural gas and other energy, are exogenous. For the first time, a distinction is made in SAFE between domestically produced exports and reexports. Reexports are goods in transit in the Netherlands, on their way from one country to another without hardly any industrial processing taking place.[25] The distinction between domestically produced exports and reexports has been incorporated in the model, on the one hand because there has been a structural change in the share of the two components in the total exports of manufactured goods, and on the other because the explanatory variables as well as the economic effects of both components differ substantially from one another.[26]

As from the mid-1980s, the Netherlands' reexport of goods increased dramatically. Already in 2000, reexports accounted for more than 40% of the Netherlands' total export of goods, whereas comparatively speaking, this figure amounted to less than 20% in 1990. It stands to reason that the share of domestically produced exports declined from more than 80% of total exports in 1990 to less than 60% ten years later.

Figure 2.2 Composition of goods and services' exports in SAFE (billion euro's, 2001)



[25] Ownership of these goods must, however, be transferred to a Dutch resident. Failing this, the goods are regarded as being transit goods. Since reexports are included in the National Accounts and transit goods are not, the ownership issue is of great significance statistically.

[26] For more information on the significance of and backgrounds to the distinction between domestically produced exports and reexports, reference is made to CPB (2001) and to Kusters and Verbruggen (2001).

The considerable change in the structure of total goods exports has a significant impact upon price sensitivity. This is because the price sensitivity of reexports is not only much lower than that of domestically produced exports, it also manifests itself in a very different manner. Whenever typical reexport products (such as computers) experience a relative drop in price, the international demand for these products is likely to rise. This in turn would increase the reexport of these products, at least if their distribution centres are established in the Netherlands. While the input of Dutch factors of production would influence the reexport price to some extent, this influence would be very tiny indeed, since the value added per euro of reexports (some 10 euro-cents) would hardly play a part. Statistically, changes in the price of reexports are virtually the same as those in the imports of these goods. For this reason, the relative price of reexports is hardly affected, if at all, by exchange rate fluctuations.

Price developments in domestically produced exports are much more affected by developments in the domestic production costs of these goods, the chief components being labour costs and the costs of imported raw materials and semi-finished goods. For every euro domestically produced exports, the Dutch people earn some 60 euro-cents. This is significantly more than for reexports, because a great deal less domestic labour is used in their production.

2.2.3.1 Volume of domestically produced exports[27]

Developments in the volume of domestically produced exports are determined by supply and demand factors. The long-term volume and price equations of domestically produced exports have been estimated simultaneously. The long-term volume equation reads as follows:

$$\ln bfb^* = 1.0 \ln mwf - 2.58(\ln p_{bfb} - \ln p_{bfc}) - 0.024 tr_{70} - 0.31 \qquad (2.10)$$

where:

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.)

Relevant world trade[28] significantly affects the volume of domestically produced exports. In addition, with a price elasticity of more than 2.5 (in absolute terms), this export category has proved to be relatively price sensitive. In the long term and assuming constant relative prices, the volume of domestically produced exports lags behind the volume of relevant world trade by

[27] For a comprehensive description of the empirical results, reference is made to Kusters et al. (2001).

[28] The calculation of relevant world trade takes account of the mix of countries and goods applicable to domestically produced exports. The goods mix is re-weighted using the shares of eight different groups of goods in domestically produced exports.

2.4% each year. Part of this negative trend variable may be attributed to a structural gap between export growth in all the industrialised countries and world trade, owing to the emergence of developing countries, notably those in Southeast Asia. A second reason for the negative trend variable could be negative mix effects not picked up by the re-weighting of world trade in terms of the Dutch mix of eight groups of goods. This could be the case, for instance, with the mix of the group of goods making up chemical products. Compared with its foreign competitors, the Netherlands is 'strong' in base chemical products (such as naphtha) and 'weak' in fine chemical products (such as cosmetics). Since the trend is for international demand for fine chemical products to grow more rapidly than the demand for base chemical products, this mix adversely affects Dutch export growth.

In the short term, volume growth of domestically produced exports is considerably less price sensitive, and with world trade elasticity slightly greater than unity, this means that Dutch exports will initially derive extra benefit from an upswing in world trade. This is related to the mix of Dutch exports, which includes relatively many base chemical products. It is the demand for these products especially that increases first and strongest when there is an international cyclical upswing, and that decreases first and strongest in case of a downswing. The short-term equation is as follows:

$$\begin{aligned} \mathring{bfb} = {} & 1.05\mathring{mwf} - 0.76(\mathring{p}_{bfb} - \mathring{p}_{bfc}) + \frac{0.54}{4}\,\mathrm{g}_2(i^{vi}_{qn} - i^{bu}_{qn})_{-4} \\ & - 0.41\,\mathrm{g}_3(\Delta qy^{vi}) - \frac{0.18}{4}(\ln bfb - \ln bfb^*)_{-1} \end{aligned} \tag{2.11}$$

where:

bfb	exports of domestically manufactured goods
mwf	relevant world trade (competing exports excluding energy, doubly reweighted)
p_{bfc}	price of competing exports excluding energy, doubly reweighted
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

Apart from price competitiveness and the volume of world trade, factors such as the innovation capacity of the export sector and the quality of the export mix also affect the growth of domestically produced exports. Measuring these factors is not simple. The approach used consists of manufacturing industry's relative investment ratio, which is the difference between the Dutch manufacturing industry's investment ratio and that of foreign competitors. Since more than 85% of domestically produced exports is manufacturing industry-based, manufacturing industry's relative investment ratio is more relevant than that of the business sector as a whole.[29]

[29] The development in the investment ratio of the manufacturing industry is linked to that of the business sector by a factor of 2.0.

The higher this relative investment ratio, the more sophisticated and innovative will be the goods Dutch industry is able to produce. It follows from this that a greater difference in the Dutch and foreign propensities to invest leads to an improvement in the Dutch market position.

The second supply factor that plays a role in the short term is the manufacturing industry's capacity utilisation rate.[30] The reasoning behind this is that when this rate is higher, entrepreneurs can still market their products, but preferring in that situation to sell their goods close to home rather than serving faraway customers abroad (the so-called Zijlstra-effect). An increase in the capacity utilisation rate will thus have an adverse effect on export growth.

2.2.3.2 Reexport volume[31]

Reexport volume is a function of relevant world trade and relative price. Relative price, which reflects the relationship between the reexport price and the competitor countries' export prices, is an indicator of international demand for reexport products, and not of the competitiveness of the 'reexport sector' in the Netherlands. Supply factors, such as the capacity utilisation rate or manufacturing industry's relative investment ratio, play no role in explaining reexport volume since, by definition, reexport products are not produced by Dutch firms.

World trade elasticity is equal to unity. Because the trend is for the ratio between reexports and relevant world trade to increase, however, it is necessary to include a trend variable as from 1970. Moreover, as from 1993, the equation has a non-linear trend variable reflecting the positive influence the actual creation of the single market is having on reexports. The long and short-term equations are as follows:

$$\ln bfm^* = 1.0 \ln mwf - 0.44(\ln p_{bfm} - \ln p_{bfc}) + 0.01 tr_{70} + 0.10(tr_{93}^{0.65}) - 0.58 \tag{2.12}$$

$$\mathring{bfm} = 1.0\mathring{mwf} - 0.49(\mathring{p_{bfm}} - \mathring{p_{bfc}}) + 0.04\Delta(tr_{93}^{0.65}) - \frac{0.59}{4} \ln \left(\frac{bfm}{bfm^*} \right)_{-1} \tag{2.13}$$

where:

bfm	reexports
bfm^*	long-term level of reexports
mwf	relevant world trade (competing exports excluding energy, doubly reweighted)
p_{bfm}	price of reexports
p_{bfc}	price of competing exports excluding energy, doubly reweighted

[30] In the model, the development in the manufacturing industry's capacity utilisation rate is linked to that in the market sector by a factor of 2.0.

[31] For a comprehensive description of the empirical results, reference is made to Kusters et al. (2001).

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

tr_{93} trend since 1993 (1993=1, 1994=2, 1995=3 etc.) related to the integration of the EU-market

Price elasticity for both the long and the short term amounts to 0.5, making reexports substantially less price sensitive than domestically produced exports. As from 1970, the coefficient of the trend variable indicates that for the period up to 1992, reexport growth was 1% higher than might have been attributable to world trade and relative price. As from 1993, the contribution of the trend variable to reexport growth has been significantly greater. Since the specification is non-linear, however, this contribution is slowly but surely declining over time. The adjustment coefficient of 0.59 suggests that worldwide reexports are adjusting relatively quickly to the long-term volume.

2.2.3.3 Export of services

Volume growth in exports of services is linked to that of goods exports by means of a simple rule of thumb.

$$\mathring{bd} = 0.60\, g_8(\mathring{bg}) \tag{2.14}$$

where:

bd exports of services

bg exports of goods

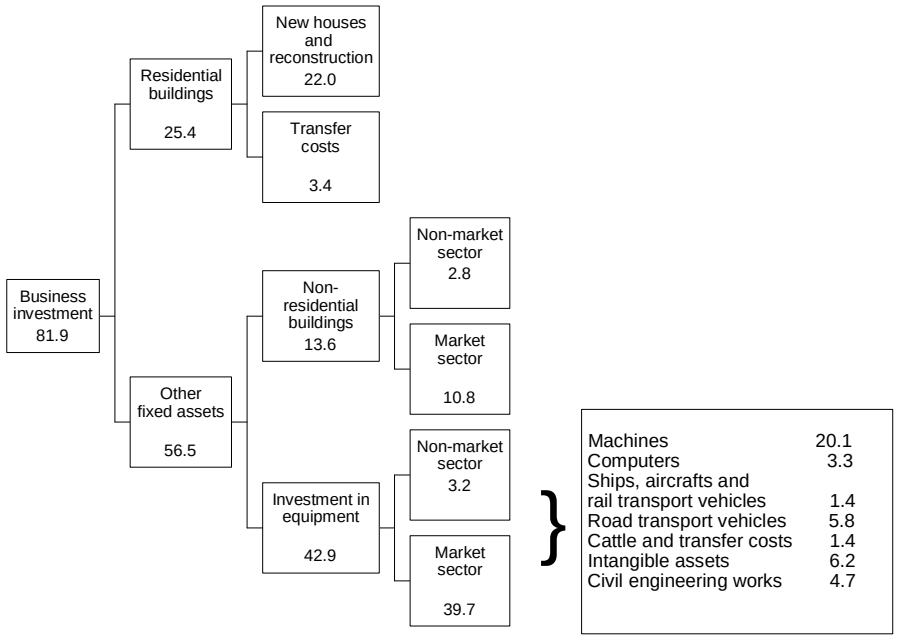
2.2.4 Business investment

In SAFE, business investment is broadly divided into three categories, namely residential building (section 2.2.4.1), other fixed assets (section 2.2.4.2) and stocks (section 2.2.4.3). The first two categories together make up business investment in fixed assets. Figure 2.3 shows the composition of these in 2001. More than 30% relates to investment in residential building. The other fixed assets create production capacity, and they in turn may be split into buildings and other. This other category is quite heterogeneous, varying from machines and computers to aircraft and intangible assets (such as software), which for the sake of simplicity is referred to below as ‘investment in equipment’.[32] Apart from the sub-division into type (non-residential buildings and other), sectoral destination of investment in other fixed assets is also relevant. Investments in the non-market sector are mainly in the health care sector (such as hospitals) and in mining and quarrying (oil and gas field exploration). These investments are exogenous

[32] The term ‘cyclically sensitive investment’ is sometimes used in CPB publications, referring to business investment excluding residential buildings, ships, aircraft, rail transport vehicles and energy sector investment (mining and quarrying, oil refinery and power stations).

because they are dependent above all on government policy or specific circumstances in the energy market.

Figure 2.3 Composition of business investment in fixed assets in SAFE (billion euro's, 2001)



2.2.4.1 Investment in residential buildings

Investment in residential buildings consists of two parts. The largest part concerns the production of new houses and the repair and alteration of existing houses. These depend on the growth in households' real disposable wage income and the interest rate.

$$\overset{\circ}{iw} = 1.3\, g_{24}(\overset{\circ}{lda})_{-2} - 0.05\, g_{4}(\Delta r_l)_{-2} \qquad (2.15)$$

where:

iw 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

The other part of investment in residential buildings concerns transfer costs. Its volume is equal to the number of transactions, and the price component is derived from the development in the price of existing houses. In SAFE, both variables are largely exogenous, price developments being linked to inflation by means of a rule of thumb for the purpose of simulation analyses.

2.2.4.2 Business investment in other fixed assets

The largest component of business investment in other fixed assets is in the market sector (see figure 2.3). In the long term, production and relative capital costs are decisive for the market sector's optimal quantity of capital. The parameters in question of the optimal stock of capital goods are in line with those of the CES production function (see section 2.2.1). The estimated long-term equations are as follows:

$$\ln k^* = \ln y - 0.32 \ln \left(\frac{p_k}{cy} \right) + \ln 0.28 \tag{2.16}$$

where all variables refer to the market sector:

k^* long-term demand for capital

y gross value added

p_k capital costs

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

Although in the long-term equation of the demand for capital (2.16) no distinction is made between non-residential buildings on the one hand and equipment on the other, for SAFE this distinction is relevant. An important reason for this is that the depreciation rate for non-residential buildings is significantly lower than for equipment. Furthermore, because of the longer useful economic life of investments in non-residential buildings, they are more dependent on long-term expectations, whereas investments in equipment are more sensitive to short-term developments in production, profitability and relative prices. In order to be able to distinguish the two investment categories in SAFE, the estimated equation of the long-term demand for capital has been split into two.

$$\ln k^{b*} = \ln y - 0.32 \ln \left(\frac{p_k^b}{cy} \right) + \ln 0.28 \tag{2.17}$$

$$\ln k^{ot*} = \ln y - 0.32 \ln \left(\frac{p_k^{ot}}{cy} \right) + \ln 0.28 \tag{2.18}$$

where all variables refer to the market sector:

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

p_k^b capital costs of non-residential buildings

k^{ot*} long-term capital demand for equipment

p_k^{ot} capital costs of equipment

A separate estimated equation has been made for the short-term dynamics of the total demand for capital (k). Apart from the components from the long-term equation (2.17 and 2.18) and the error correction model, this separate estimated equation also includes a profitability indicator (p_y/c). The underlying reason for this is that as long as entrepreneurs earn a profit, there is not

the same inducement for them to produce making the most efficient use of labour and capital as there would otherwise be. If profitability is under pressure, they will endeavour to produce more efficiently, which more often than not will mean cuts in the input of capital and/or labour.

The estimated short-term equation of the total demand for capital has not been directly included in SAFE but rewritten and split into two short-term equations of investments in non-residential buildings (2.19) and investments in equipment (2.20). To this end, use has been made of the definition that the quotient of investments and the stock of capital goods (i/k^*) is equal to the growth in the stock of capital goods plus the rate of depreciation (δ).[33] The equation of the investment ratio follows from the growth equation of the stock of capital goods, from which can then be derived the level of and increase in investment. The equations of the two individual investment categories are as follows:

$$\begin{aligned}(i^b/k^b_{-1}) = {} & 0.65\,\mathrm{g}_{22}(\mathring{k}^b) + 0.06\,\mathrm{g}_{22}(\mathring{y}) + 0.04\,\mathrm{g}_{22}(\mathring{y}_{-4}) \\ & - 0.05(\mathrm{g}_{22}(\mathring{p}^b_k) - \mathrm{g}_{22}(\mathring{cy})) + \frac{0.03}{4}\ln(\mathrm{g}_{22}(p_y/c)) \\ & - \frac{0.017}{4}(\ln k^b - \ln k^{b*})_{-1} + \delta^b\end{aligned} \tag{2.19}$$

$$\begin{aligned}(i^{ot}/k^{ot}_{-1}) = {} & 0.4\,\mathrm{g}_{13}(\mathring{k}^{ot}_{-2}) + 0.14\,\mathrm{g}_{22}(\mathring{y}) + 0.09\,\mathrm{g}_{22}(\mathring{y}_{-4}) \\ & - 0.21(\mathrm{g}_{22}(\mathring{p}^{ot}_k) - \mathrm{g}_{22}(\mathring{cy})) + \frac{0.14}{4}\ln(\mathrm{g}_{12}(p_y/c)) \\ & - \frac{0.045}{4}(\ln k^{ot} - \ln k^{ot*})_{-1} + \delta^{ot}\end{aligned} \tag{2.20}$$

where all variables refer to the market sector:

i^b	investment in non-residential buildings (excluding civil engineering works)
k^b	capital stock in non-residential buildings
k^{b*}	long-term capital demand for non-residential buildings
y	gross value added
p^b_k	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^{ot}_k	capital costs of equipment
δ^b	rate of depreciation of k^b (0.0275)
δ^{ot}	rate of depreciation of k^{ot} (0.097)

[33] $i_t = k_t - k_{t-1} + \delta k_{t-1}$ applies to both buildings and equipment. By definition, it follows from this that $i_t/k_{t-1} = (k_t - k_{t-1})/k_{t-1} + \delta$.

The equations (2.19) and (2.20) suggest that investments in equipment are more sensitive to changes in production, relative capital costs and profitability than are investments in buildings. Furthermore, time lags are shorter and the investments in equipment adapt more rapidly to the optimal stock of capital goods. In addition, these investments would appear to be depreciated nearly four times faster.

2.2.4.3 Investment in inventory formation

The last component of business investment concerns investments in inventory formation. By definition, inventory formation is equal to the adjustment to stocks. Because flow variables have been included in SAFE on a yearly basis, a factor 4 should be taken into account. A distinction is made between an exogenous variable, namely the inventory formation of energy products, and an endogenous variable, which includes all inventory formation except energy products. Stock keeping is determined by the transaction motive and the buffer function. No empirical indications have been found for stock keeping on speculative grounds.

The transaction motive induces entrepreneurs to hold part of their expected turnover in the form of stocks. Considering the need for an appropriate stock-sales ratio, additional turnover expectations result in additional inventory formation. Stock keeping does entail costs, however, so that the required stocks will also depend on the relevant real rate of interest. This rate is calculated as a weighted average of the long and short-term rates of interest, deflated by the calculated price of stocks.

The buffer function of stocks comes into its own when unexpected growth in turnover is absorbed by growth in stocks. To this end, the difference between the expected and the actual growth in turnover has been included as indicator. The expected growth in turnover is a distributed time lag in the actual growth in turnover, where the inventory formation induced by the buffer mechanism can be expressed as a lag in the actual growth in turnover.

The inventory formation equation, where both the transaction motive and the buffer function are reflected in the first variable, is as follows:

$$\frac{nf}{VC_{-1}} = 4(0.20\frac{g_3(\Delta vc)_{-1}}{VC_{-1}}) - 4(0.05\mathring{v}c) - \frac{4}{100}(0.01125\, g_9(\Delta r_{cv})) \qquad (2.21)$$

where:

nf inventory formation excluding energy

vc gross domestic production excluding exports of energy, inventory formation, indirect taxes and subsidies

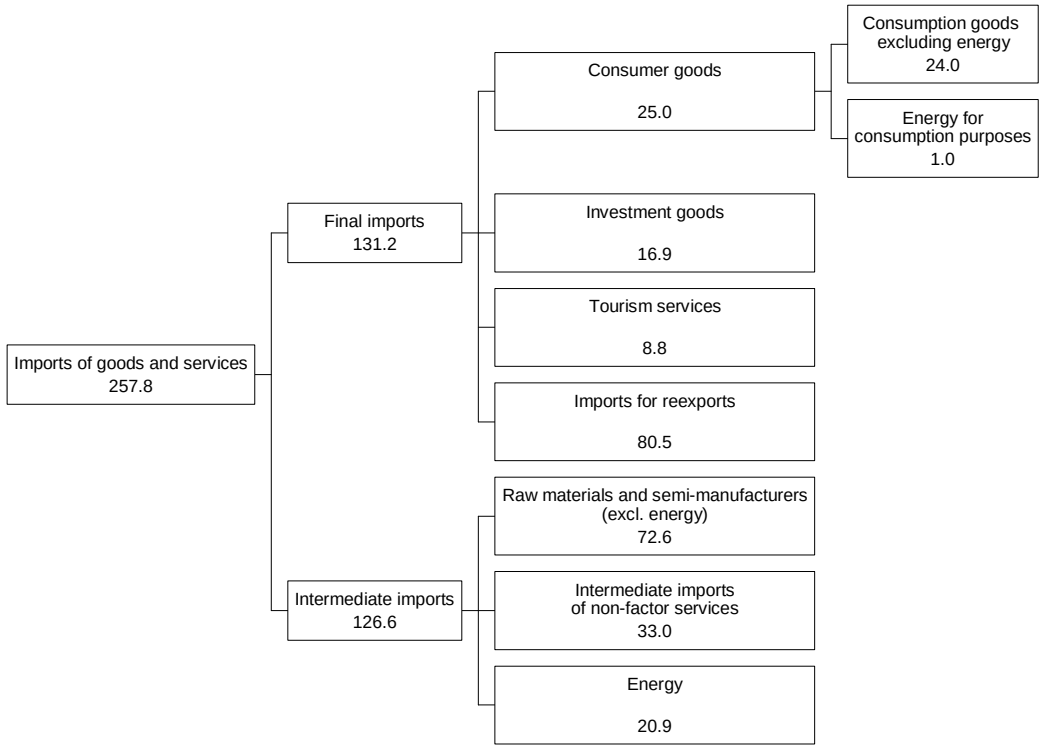
r_{cv} real interest rate, relevant for inventory formation

In the long-term, the stock to sales ratio is 15% ($0.20 - 0.05$).

2.2.5 Imports of goods and services

The imports of goods and services is sub-divided into final products (final imports) and intermediate imports. This distinction is important because for both categories the explanatory variables as well as income elasticity and price elasticity can differ. Higher income elasticity and price elasticity may thus be expected for final goods imports than for intermediate imports, because the latter consist mainly of raw materials and semi-manufactures that are not or cannot be produced domestically. Figure 2.4 shows that in SAFE, imports of final goods are sub-divided into consumer goods, tourism services, investment goods, and imports for reexport.[34] For businesses, intermediate imports consist of raw materials and semi-manufactures (excluding energy), energy and non-factor services.

Figure 2.4 Composition of imports of goods and services in SAFE (billion euro's, 2001)



2.2.5.1 Final imports of goods and services

By far the largest final imports' component concerns imports for reexports. Volume changes in the imports for reexports are equal to those of reexports itself.

The other equations of the final imports' components all have broadly the same structure.

[34] Changes in the volume of energy imports for consumption purposes are supposed to correspond to volume changes in consumer goods imports excluding energy.

Apart from relevant turnover, final imports are determined by relevant price and in some cases by import penetration trends. In the case of consumer goods imports (excluding energy), the relevant turnover category is private consumption, adjusted for the consumption of residential services (actual and imputed rentals) and private health-care consumption (medical care and welfare services paid for by households). The two last-named categories are hardly imported, if at all, nor do they depend on disposable income. The sales elasticity, which may be interpreted as a kind of income elasticity, is greater than unity. This is because the share of luxury durable consumer goods, which often originate from abroad, is relatively large.

There is substitution when imported consumer goods become cheaper than domestically produced consumer goods. There is a time lag in this substitution process because consumers cannot take advantage of the differences in price immediately. Price elasticity is equal to -0.62. Structural import penetration, which is attributable to the ongoing globalisation among other things, amounts to ½% per year.

$$\mathring{m}_c = 1.54\mathring{cre} - 0.62\,\mathrm{g}_5(\mathring{p}_{mc} - \mathring{p}^{bh}_{cre})_{-1} + \frac{0.005}{4} \tag{2.22}$$

where:

m_c imports of consumer goods (excluding energy)

cre 'free' private consumption

p_{mc} price of m_c

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

The imports of investment goods is determined allowing for a sales elasticity equal to unity. Price elasticity is slightly lower than that of consumer goods, while at 1½% per year, structural import penetration of investment goods is markedly higher.

Apart from these variables, the capacity utilisation rate (qy) also affects the import of investment goods. Increasing underutilisation of production capacity translates into a greater market share of domestically produced goods, since these can be delivered faster and with more service being provided. This variable is the equivalent of the 'Zijlstra-effect' in the case of goods exports. Lastly, the imports of aircraft is taken into account separately because they are imported in full and this import category is highly erratic as well.

$$\begin{aligned}\mathring{m}_i = {} & 1.0\mathring{ibc} - 0.50\,\mathrm{g}_5(\mathring{p}_{mi} - \mathring{p}^{bh}_{ibo-1}) + 0.50\,\mathrm{g}_6(\Delta qy)_{-1} \\ & + \left\{\left(\frac{i^{vl}}{m_i}\right)_{-1}\right\}\mathring{i}^{vl} + \frac{0.015}{4}\end{aligned} \tag{2.23}$$

where:

m_i imports of investment goods

ibc investment in equipment

p_{mi} price of m_i

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

qy capacity utilisation rate market sector

i_{vl} private investment in aircrafts

Imports of tourism services mostly concern spending by Dutch residents during holidays abroad. This is why the growth rate is closely tied to that of domestic household consumption. The change in the import price of tourism services relative to the price change of total consumption plays a role as well. Owing to the luxury nature of this consumption category, in absolute terms elasticity is somewhat greater than for consumer goods.

$$\mathring{m}_{dc} = 1.75\mathring{cre} - 0.75\,\mathrm{g}_5(\mathring{p}_{mdc} - \mathring{p}_c)_{-2} \tag{2.24}$$

where:

m_{dc} imports of tourism services

cre 'free' private consumption

p_{mdc} price of m_{dc}

p_c price of private consumption

2.2.5.2 Intermediate imports

By far the largest category of intermediate imports concerns raw materials and semi-manufactures (excluding energy). As with the other import categories, changes are largely determined by those in the relevant turnover and relative price. Relevant turnover is sales of domestic origin, re-weighted by reference to import intensity, where the weights correspond to the cumulative import ratios of the individual sales categories. Imports of raw materials and semi-manufactures are mostly utilised directly in the production process, some part finding its way into stock adjustments, however. Imports for inventory formations are linked to it by means of an import ratio of 0.70. To put it differently, the rule of thumb that is used is that 70% of inventory formation (excluding energy) consists of imported raw materials and semi-manufactures. With a price elasticity of 0.3, the price sensitivity of this import category is relatively low because many raw materials cannot be produced domestically.

$$\mathring{mgr} = 1.0\mathring{vmg} - 0.3\,\mathrm{g}_3(\mathring{p}_{mgr} - \mathring{p}_{vmg}) + 0.7\left(\frac{\Delta nf}{MGR_{-1}}\right) \tag{2.25}$$

where:

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

vmg final sales of domestically manufactured products, reweighted to their import (mgr) share

p_{mgr} price of mgr

p_{vmg} price of vmg

nf inventory formation excluding energy

The equations of changes in energy imports and (intermediate) services have the same structure and elasticity as the above equation, except that the weights of the individual spending categories in the output variables, re-weighted by reference to import intensity, are slightly different. In the relevant output for the import of energy, the export of energy (excluding natural gas), for example, has by far the largest coefficient (more than 0.5), whereas in the other output variables re-weighted by reference to import intensity, this coefficient is zero. The inventory formation relevant to energy imports relates to energy products, whereas in the import of services by businesses, this variable obviously plays no role.

2.2.6 Prices and costs

2.2.6.1 General

For the principal output categories, SAFE contains two types of prices, namely a final output price (at market prices) and prices of domestically produced goods and services (at factor costs). For private consumption, the model also contains a rule of thumb for changes in the consumer price index (CPI).[35] The final output price of every demand category is calculated using the relevant price of domestically produced output, the relevant import price of final goods, and the appropriate indirect tax burden (including price-lowering subsidies).

Prices of domestically produced output are at the core of SAFE's price block. While these output prices are determined largely by the costs of Dutch producers, they are also affected by the prices of foreign competitors and the capacity utilisation rate. When costs rise faster in the Netherlands than they do abroad, the rise in costs cannot be fully passed on in the form of higher prices because of the influence of foreign competition, so that profit margins shrink. The reasoning behind the inclusion of the capacity utilisation rate is that when it is low and/or declining, entrepreneurs are prepared to make price concessions, which will likewise be at the expense of profit margins.

Changes in costs are passed on in prices only with some delay. Given the price equations, differences between changes in the various cost categories not subject to any time lag and changes in the model's cost variables, are reflected in changes in the profit margin.

2.2.6.2 Cost equations

SAFE calculates product unit costs for twelve output categories (see table 2.2), a distinction being made between the following cost categories:

- labour costs per unit of product

[35] The difference between the consumption price and the CPI is mainly attributable to a difference in weighting. In the CPI, price developments in consumption components are weighted using the fixed weights of the 1995 Budget Survey, whereas in the National Accounts chain-indices (flexible weights) are used to determine consumption prices. Recently, Statistics Netherlands (CBS) switched to flexible weights (of three years ago) for the CPI as well. While the gap between the two inflation figures is accordingly expected to narrow, it is not expected to be completely eliminated, however.

- costs of imported intermediaries, split into raw materials and semi-manufactures, services and energy
- costs of domestically produced natural gas
- user costs of capital

An aggregate weighting is made of these cost categories using cumulative cost shares that are updated yearly on the basis of the most recent CBS (Statistics Netherlands) input-output table (see table 2.2). Average product unit costs are arrived at as follows:[36]

$$\begin{aligned}\mathring{k}_j = (1-g_j-s_j-o_j-a_j-\lambda_j)_{-4}\left[\mathrm{g}_1(\mathring{p}_{lle}) - \left(\mathrm{g}_2(\mathring{h}^{ms}) + \frac{\eta_j}{400}\right)\right] \\ + \lambda_{j_{-4}}\,\mathrm{g}_3(\mathring{p}_{k,j}) + g_{j_{-4}}\,\mathrm{g}_{23}(\mathring{p}_{mgr}) + s_{j_{-4}}\,\mathrm{g}_{23}(\mathring{p}_{mdb}) \\ + o_{j_{-4}}\,\mathrm{g}_{23}(\mathring{p}_{m3}) + a_{j_{-4}}\mathring{p}_{vag}\end{aligned} \tag{2.26}$$

where:

k_j	units costs for (domestically produced) demand category j
p_{lle}	private sector wage rate, excluding wage costs subsidies
h^{ms}	labour productivity market sector
$p_{k,j}$	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

The calculation of product unit labour costs takes into account the differences in structural labour productivity growth per output category. Since productivity growth in industry is higher on average than in the market sector, increases in the product unit labour costs of goods exports, a significant part of which is produced by industry, will be below those of the market sector as a whole. Increases in the product unit labour costs of investments in buildings, on the other hand,

[36] For the purpose of determining the product unit costs of construction-related investments and of export categories, intermediate import prices are subject to a g_8 time lag function.

will be above those of the market sector as a whole, given that productivity growth in the construction industry is relatively low.

For this reason, developments in market sector productivity used to determine the product unit labour costs of the individual output categories have been adjusted by an additive factor of (η_j).[37] For the determination of capital costs, a distinction is made in SAFE between user costs of equipment and those of buildings. In order to arrive at the relevant capital costs per output category, the model takes account of the fact that equipment and buildings have user intensities that differ per output category. User costs of both equipment and buildings (i.e. user costs of capital) are derived from effective investment prices reduced to their present value, account being taken of the effect of taxation and tax relief facilities. The relevant rate of interest plays a central role. It is arrived at by increasing the net long-term rate by a risk premium and the depreciation rate, and deducting from this the expected rise in the cost of investments. Since a substantial portion (0.65) of interest expenses is fixed, only part (0.35) of a change in the long-term rate of interest affects the relevant rate of interest.

$$p_k^{ot} = p_{ibc}\left\{\frac{(1-uvp\times da_{ou})}{1-uvp}\right\}\left[(1-uvp)\left\{0.35\,\mathrm{g}_2(r_l)_{-1}+0.65\times 8\right\}+3.8\right]/100 \qquad (2.27)$$

$$p_k^{b} = p_{ibb}\left\{\frac{(1-uvp\times da_{gb})}{1-uvp}\right\}\left[(1-uvp)\left\{0.35\,\mathrm{g}_2(r_l)_{-1}+0.65\times 8\right\}-0.3\right]/100 \qquad (2.28)$$

where:

p_k^{ot} user costs of equipment

p_k^{b} user costs of non-residential buildings

p_{ibc} price of private investment in equipment

p_{ibb} price of private investment in non-residential buildings

uvp corporate profit tax

da_{ou} present value of tax deductible depreciation allowances per euro of investment in equipment

da_{gb} present value of tax deductible depreciation allowances per euro of investment in non-residential buildings

r_l long-term interest rate

[37] In previous versions of SAFE and its predecessors this adjustment was multiplicative, that is to say that labour productivity growth in the market sector was multiplied by a factor that differed per turnover category. In the event of negative market sector productivity growth of any significance, as was seen in the post war period for the first time in 2001, multiplicative modelling yields very few plausible results, however. In that case, the model assumes that productivity growth in industry, for instance, is more negative than it is in the market sector, whereas productivity growth in the construction industry would than be relatively favourable, which is not plausible. In the current version of SAFE, the additive modelling option has therefore been preferred. For more information on this, reference is made to Kranendonk and Verbruggen (2001).

Table 2.2 gives an overview of the cumulative cost shares and the additive factor (η_j) of the main output categories. This table indicates that labour costs are the largest cost component in virtually all output categories. For reexports, the cumulative labour cost ratio is even relatively high, which indicates that the domestically produced part of reexports, consisting mainly of trade and transport services, is relatively labour intensive. Comparatively speaking, a great deal is imported for the production of exported goods and services. The largest cost component in the export of energy (oil products) is energy imports (notably crude oil).

Table 2.2 Cumulated cost shares and additive productivity factors for demand categories, 2001

	cost components						
	Labour	Imported raw materials and semi-manu-factures	Imported intermediate services	Imported energy	Natural gas consumption by enterprises	Capital	
		g_j	s_j	o_j	a_j	λ_j	η_j
Private consumption							
Total excluding fixed expenses	0.54	0.12	0.09	0.02	0.01	0.22	−0.80
Medical services	0.69	0.07	0.01	0.00	0.00	0.24	−2.00
Exports							
Manufactures	0.40	0.30	0.06	0.03	0.01	0.20	1.35
Reexports	0.59	0.08	0.09	0.01	0.00	0.22	1.70
Services	0.51	0.10	0.15	0.02	0.01	0.21	0.00
Energy (excluding natural gas)	0.11	0.10	0.02	0.62	0.03	0.11	3.00
Private investment							
Equipment	0.54	0.17	0.07	0.01	0.01	0.20	−0.30
Non-residential buildings	0.57	0.19	0.05	0.01	0.01	0.18	−1.20
Residential buildings (excluding transfer costs)	0.57	0.19	0.05	0.01	0.01	0.18	−1.20
Government							
Government sales	0.64	0.07	0.04	0.01	0.00	0.24	−1.20
Benefits in kind	0.43	0.08	0.04	0.01	0.00	0.44	−0.20
Intermediate deliveries	0.43	0.19	0.11	0.03	0.01	0.23	0.00

2.2.6.3 Price equations

As mentioned earlier, output prices of domestic origin are determined by the prices of foreign competition as well as by costs and the capacity utilisation rate. The coefficients of the cost variable and the price of competitors add up to one, which means that equations have linear homogeneity. Both the change in the capacity utilisation rate and its level affect the indicator of

market conditions. When the capacity utilisation rate is relatively low, the price-lowering effect is limited, since the profit margin would otherwise come under too much pressure. The capacity utilisation rate in the processing industry is of relevance to price changes in goods exports produced domestically, whereas in the other price equations the market sector's capacity utilisation rate has been used. For the main output categories, the price equations of goods and services produced domestically are reviewed below. Price developments in the other categories are determined entirely by the relevant changes in costs or as the weighted average of other price developments.

In determining the price of private consumption produced domestically, separate account is taken of the contribution of price developments in residential services (actual and imputed rentals), households' natural gas consumption, and the private consumption of health care services, since these prices constitute a policy pretext. Of the price development in other private consumption, 70% is determined by cost factors and 30% by the price development of foreign competitors in the domestic market. The normal level of capacity utilisation of the sector that produces consumer goods is 0.827. The price-lowering effect of a capacity utilisation level below this normal value is limited to -0.5%-point on a yearly basis.

$$\begin{aligned}\mathring{p}_c^{bh} = {} & \left[1.0 - \left(\frac{C_{ag}+C_{wo}+C_{kg}}{C_{bh}}\right)_{-1}\right]\Big\{0.3\,\mathrm{g}_{18}(\mathring{p}_{mc}) + 0.7\mathring{k}_c \\ & + 0.25\,\mathrm{g}_{14}(\Delta qy^{ms}) + \frac{0.10}{4}\max(\mathrm{g}_{13}(qy^{ms}) - 0.827, -0.05)\Big\} \\ & + \left(\frac{C_{ag}}{C_{bh}}\right)_{-1}\mathring{p}_{cag}^{bh} + \left(\frac{C_{wo}}{C_{bh}}\right)_{-1}\mathring{p}_{cwo}^{bh} + \left(\frac{C_{kg}}{C_{bh}}\right)_{-1}\mathring{p}_{ckg}^{bh}\end{aligned} \tag{2.29}$$

where:

p_c^{bh}	price of domestically produced private consumption (at factor costs)
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
k_c	unit costs for domestically produced private consumption
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

In the long term, the price of domestically produced export goods is determined entirely by production costs. If the price varies from its long-term level, this will be adjusted via the error correction model. The parameter in question ($-0.11/4$) indicates that this adjustment process is

slow. Moreover, in the short term, 78% of the changes in export prices are determined by changes in costs and 22% by developments in the prices of foreign competitors. In addition, influence is exerted by market conditions via the level of and change in the processing industry's capacity utilisation rate.[38] The price-lowering effect of a capacity utilisation rate that is below the normal level of 0.82 is limited to -1.25 percentage points on a yearly basis.

$$\begin{aligned} \mathring{p}^{bh}_{bfb} &= 0.22\mathring{p}_{bfc} + 0.78\mathring{k}_{bfb} + 0.21\,\mathrm{g}_{10}\,\Delta(qy^{vi})_{-1} \\ &\quad + \frac{0.25}{4}\max(\mathrm{g}_{13}(qy^{vi}) - 0.82, -0.05) - \frac{0.11}{4}\ln(\frac{p^{bh}_{bfb}}{p^{bh*}_{bfb}})_{-1} \end{aligned} \tag{2.30}$$

$$\ln p^{bh*}_{bfb} = \ln k_{bfb} \tag{2.31}$$

where:

p^{bh}_{bfb}	price of domestically produced exports of manufactures (at factor costs)
p^{bh*}_{bfb}	long-term value of p^{bh}_{bfb}
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

Some 90% of the final output price of reexports is determined by the exogenous import price of the goods concerned and some 10% by domestic cost factors. Table 2.2 shows that labour costs are the largest component of the domestically produced share of reexports.

Relevant cost changes account for 70% of price developments in domestically produced investments in equipment (including transport equipment and civil engineering works) and the price of competitors for 30%. The cost of investments in business and residential buildings, on the other hand, is not affected by the price of competitors. The investment cost of houses (excluding transfer duty), however, is affected by the price ratio between existing and new houses in the recent past; when existing houses become relatively more expensive, this has an upward effect on the cost of investment in houses.

As with private consumption, changes in the cost of domestically produced investment components take account of tension in the goods market by means of the change in and the level of the market sector's capacity utilisation rate. The price-lowering effect of a level of capacity utilisation that is under the normal rate is limited to 0.5%-point on a yearly basis.

$$\begin{aligned} \mathring{p}^{bh}_{ibo} &= 0.30\,\mathrm{g}_{18}(\mathring{p}_{mi} + 0.70\mathring{k}_{ibo} + 0.25\,\mathrm{g}_{10}(\Delta qy^{ms}_{-1}) \\ &\quad + \frac{0.10}{4}\max(\mathrm{g}_{13}(qy^{ms}) - 0.824, -0.05) \end{aligned} \tag{2.32}$$

[38] In the model, the change in the manufacturing industry's capacity utilisation rate is linked to that in the market sector by a factor of 2.0.

$$\mathring{p}_{ibb}^{bh} = \mathrm{g}_{12}(\mathring{k}_{ibb}) + 0.20\,\mathrm{g}_{14}(\Delta qy^{ms}) + \frac{0.10}{4}\max\left[\mathrm{g}_{13}(qy^{ms}) - 0.835, -0.05\right] \tag{2.33}$$

$$\begin{aligned}\mathring{p}_{iwx}^{bh} = {} & \mathrm{g}_{12}(\mathring{k}_{iwx}) + 0.20\,\mathrm{g}_{14}(\Delta qy^{ms}) + \frac{0.10}{4}\max[\mathrm{g}_{13}(qy^{ms}) - 0.834, -0.05] \\ & + 0.15\,\mathrm{g}_{3}(\mathring{p}_{wh} - \mathring{p}_{iwx})_{-1}\end{aligned} \tag{2.34}$$

where:

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

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

p_{iwx}^{bh} 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)

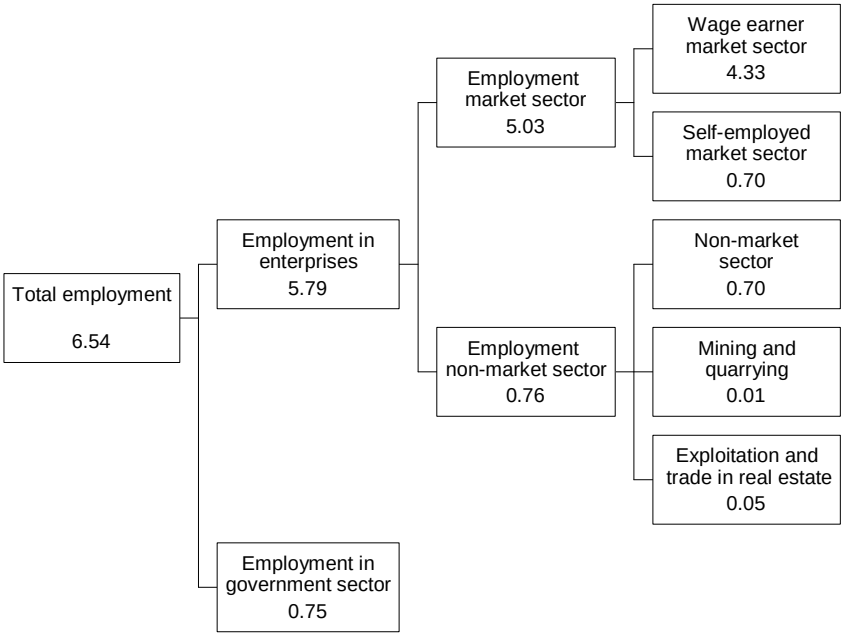
2.3 Labour market

The discussion of the labour market starts with the demand for labour (section 2.3.1) followed by the supply of labour and unemployment (section 2.3.2). Lastly, section 2.3.3 deals with the pricing of labour, also known as the wage rate.

2.3.1 Employment

Broadly speaking, total employment is sub-divided in SAFE into three components, namely employment in the market sector, in the non-market sector and in the general government. Of these components, the last two are exogenous. In addition, a distinction is made into type of employment: wage earners and the self-employed. The number of wage earners is arrived at by deducting the number of self-employed, which is exogenous in SAFE, from total employment. The self-employed are not only found in the market sector but in the health care sector as well. All of SAFE's employment components differentiated into numbers of labour years (see figure 2.5), are also differentiated into numbers of persons. They are linked to each other by means of p/a ratios. These ratios between persons and labour years differ per employment component and vary (in 2002) from 1.04 in the mining and quarrying industry to 1.22 for the

Figure 2.5 Composition of employment in SAFE (million labour years, 2001)



self-employed and in the health care sector. The higher the p/a ratio, the more work is done on a part-time basis.

Employment in the market sector (in labour years) follows from the CES production function (see section 2.2.1). Based on the estimated coefficients, such as price elasticity of -0.32, the demand for labour in the long term is as follows:[39]

$$\ln a^* = \ln y - 0.32 \ln(\frac{p_{le}}{cy}) - \ln d_l - v_l^* + \ln 0.72 \qquad (2.35)$$

where all variables refer to the market sector:

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)

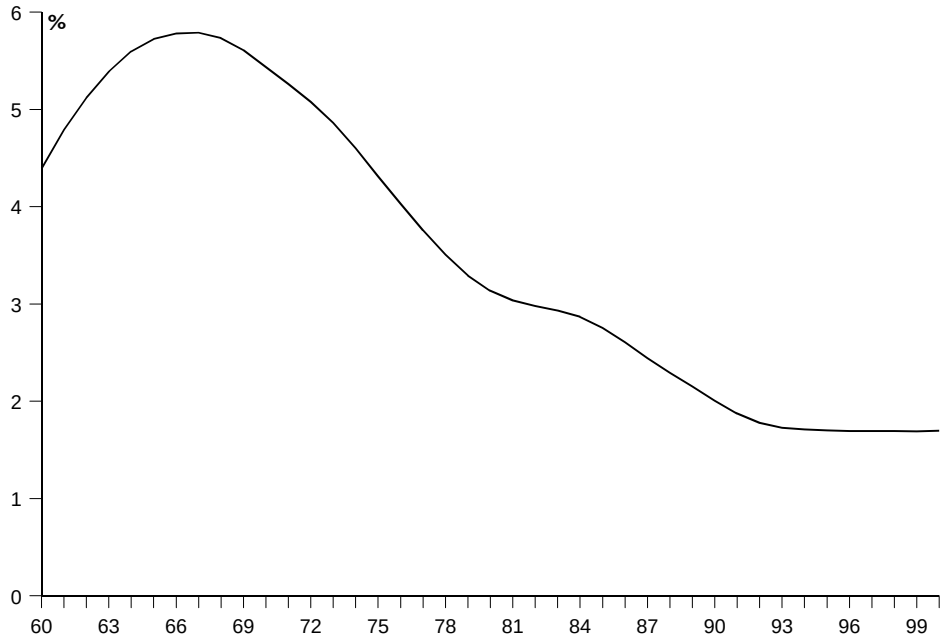
v_l^* structural degree of labour-saving technical progress

The demand for labour goes up as production increases, relative labour costs go down or working hours decrease. The demand for labour goes down, however, owing to advances in labour-saving techniques. This technical progress is not a constant but a progression that varies over time, calculated ('flattened') using a Hodrick-Prescott filter and an Arima model from the

[39] See Draper et al. (2001).

actual growth in market sector labour productivity. The pace of growth declines steadily from nearly 6% in the latter half of the 1960s to approximately 1.7%.[40]

Figure 2.6 Estimated structural degree of labour-saving technical progress, 1960 - 2000



The short-term equation has been modelled like an ECM specification of the long-term equation (see section 1.3.4). In addition to the error correction term, the production and the relative labour costs, this equation contains a profitability indicator as well. As with the short-term equation of the demand for capital, the reasoning behind this is that as long as a profit is earned, entrepreneurs will not be as inclined to produce using the most efficient input of labour and capital as they might otherwise be. As soon as profitability drops, there will be a tendency to produce more efficiently, which more often than not will mean cuts in capital and/or labour. The profitability variable contains the average cost, production being divided into the sum of wages and the costs of capital, unlike the minimal costs which are of relevance to the relative cost of labour (p_{le}/cy).[41] Changes in working hours and technology do not directly affect the short-term specification, the effects being felt via the long-term equation. SAFE incorporates the following employment equation for the short term:

$$\mathring{a} = 0.5\,g_{21}(\mathring{y}_{-1}) + 0.33\,g_{6}[\ln(\frac{p_y}{c})] - 0.3\ln(\frac{p_{le}}{cy}) - \frac{0.23}{4}(\ln a - \ln a^*)_{-1} \qquad (2.36)$$

[40] See van der Wiel (2001), page 27 and subsequent pages.

[41] See section 2.2.1 for the determination of these minimal costs.

where all variables refer to the market sector:

a	employment (in labour years)
p_y	price of gross value added
c	average cost price
p_{le}	labour cost in efficiency units
cy	minimal cost per unit output (according to production function)

2.3.2 Labour supply and unemployment

In terms of persons, labour supply is determined for the most part by trend factors such as demographic developments and labour force participation rates. Since these factors have not been modelled in SAFE, the labour supply is largely exogenous. There are two endogenous factors as well, however. Firstly, changes in the supply of labour depend on tensions in the labour market, the so-called discouraged-worker effect. Easing of the labour market or a rise in the rate of unemployment, depresses the supply of labour, since there will be fewer chances of finding work and the costs involved in it will increase.

Secondly, changes in the labour supply are affected by developments in real disposable wages. The positive coefficient that emerges implies that the substitution effect is more important than the income effect. On balance, a rise in real disposable wages results in an increase in the supply of labour, albeit with quite a long time lag.

$$\Delta as = \Delta ast + 0.2\,\mathrm{g}_{10}(\Delta a_p - \Delta ast)_{-1} + 0.1[\mathrm{g}_{24}(\mathring{p}_{lb} - \mathring{p}_c - \mathring{twl})_{-1}]ast \qquad (2.37)$$

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

Unemployment is arrived at by reducing the labour supply (in terms of persons) by aggregate employment (likewise in terms of persons). Aggregate employment consists of business sector employment (employees and the self-employed) and general government employment.

2.3.3 Wages

Of all the variables, wages are one of the principal determinants of economic development. The reason is that virtually all main economic variables are affected directly or indirectly by the level of and changes in the wage rate. Not only are wages an income component, and as such an

important element in the financial elbowroom of households, they are a substantial cost component as well that affects profitability, price competitiveness and the rate of inflation, among other things. In addition, changes in the wage rate are of considerable importance to tax and premium revenues, as well as general government expenditure, a large part of which is made up of wage-sensitive components. It is therefore not surprising that outcomes produced by models are generally very sensitive to the specification of wage equations.

The modelling of changes in wage rates differentiates between the long and the short term. Short-term wage developments are determined by three components: contractual wage rate growth, incidental wage rate growth and changes in the employers' social security contributions.

For an explanation of the wage rate in the long term, a right-to-manage model is used.[42] In accordance with this type of model, the wage rate is the outcome of negotiations between employers organisations and trade unions. The long-term equation for the market sector's wage rate is as follows:[43]

$$\ln p_l^{ms*} = \ln p_y^{ms} + \ln h^{ms} + 0.34 \ln \Lambda + 0.15 \ln rp - 2.0 u_{-4} \tag{2.38}$$

with

$$\Lambda = [1/(1-t_{wm})](1+t_{ww})(1+t_k) \tag{2.39}$$

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
Λ	wedge
rp	replacement rate
u	unemployment rate
t_{wm}	employees' tax and premium burden on wage income
t_{ww}	employees' social security premium burden on wage income
t_k	indirect tax rate

In the wage equation for the long-term, cost of production as well as labour productivity have a coefficient equal to unity. In addition, the long-term wage rate depends on the fallback position of dismissed workers. The effect of an improvement in this fallback position is to push up the

[42] For a derivation of such a model see Graafland and Huizinga (1999).

[43] In the original estimated equation, [see CPB (1997), page 28] the replacement rate coefficient was higher and that of the unemployment rate slightly lower than in the equation below. In SAFE, these coefficients have been temporarily adjusted owing to the tight conditions in the labour market. After all, under these conditions, the replacement rate will play a lesser role in wage negotiations than would be the case when conditions in this market have eased.

wage rate. The fallback position of dismissed workers depends on the wedge, the replacement rate and the unemployment rate. An increase in the wedge produces a relative improvement in this fallback position.[44] This is so because it is assumed that the unemployed spend part of their time on informal sector activities, whereas the revenue generated by these activities is not affected by the wedge. The impact of the replacement rate on the fallback position is obvious. The rate of unemployment affects this fallback position because the better the chances of finding a job, the lower will be the expected value of the income loss in the event of dismissal. The wedge (Λ) is expressed in real terms and may be described as the quotient of the real costs of labour and real disposable wages. In SAFE, the wedge term has been so modelled that only changes in it that result from adjustments to the tax and premium burden on wage income (t_{wm} en t_{ww}) and changes in indirect tax rates (t_k) affect the long-term wage rate.[45]

The short-term equation for contractual wages in the market sector is as follows:

$$\mathring{p}_{lc}^{ms} = \mathring{p}_{y}^{ms} + 0.5(\mathring{p}_{ci} - \mathring{p}_{y}^{ms}) + 0.2t\mathring{w}m - 0.2t\mathring{w}w + 0.064r\mathring{p} - 0.21\Delta u + \frac{0.85}{4}(\ln p_l^* - \ln p_l)_{-1} \tag{2.40}$$

where:

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 premium burden on wage income

t_{ww} employers' social security premium burden on wage income

The increase in contractual wage rate in the short term depends firstly on the difference between the long-term value and current value of the market sector's wage rate. Some 21% of any difference between these two is eliminated in the next quarter via the error correction model. In the short term, an increase in contractual wage rate also depends on an increase in the cost of gross value added (in the market sector) and an increase in the consumer price index (both having an elasticity of 0.5). A higher burden of taxes and premiums weighing on employees' wage income results in a higher increase in contractual wages, whereas an increase in the social security contributions of employers results in a more moderate increase in these wages.

[44] When making a central projection, account is taken of the average burden of direct taxes and premiums at the micro level, which is produced without using the model. For the purpose of simulation analysis, changes in the average burden at the micro level are linked to changes in the burden of direct taxes and premiums at the macro level.

[45] By deflating labour costs by the cost of production, and disposable wages by the consumer price index, the wedge in terms of its definition could additionally change as a result of a change in the external terms of trade. Such a change would not have any effect on the long-term wage rate in SAFE, however.

Moreover, any change in the replacement rate and any change in the rate of employment affect developments in contractual wage rate in the short term. Note that changes in labour productivity do not directly affect developments in contractual wages in the short term; they only do so indirectly via the error correction model.

The incidental wage rate equation is as follows:

$$\mathring{p}_{li}^{ms} = 0.4\mathring{h}^{ms} - 0.69\Delta u_{-1} - 0.0008 \qquad (2.41)$$

where:

p_{li}^{ms} incidental wage rate, market sector
h^{ms} labour productivity, market sector
u unemployment rate

While an increase in labour productivity has a positive effect on the incidental wage rate, sometimes referred to as wage drift, changes in unemployment rates have an adverse effect on them.

2.4 Tension in the economy

2.4.1 Introduction

The capacity utilisation rate is the traditional tension indicator for the goods and services market as is the unemployment rate for the labour market. In addition, what is known as the output gap has been in vogue for some time as the tension indicator for the economy as a whole. The output gap - which is also used to measure the structural general government financial balance (see section 2.5.3) - is equal to the difference between actual and potential output (in terms of volume), expressed as a percentage of potential output. Potential output is the level of production that can be sustained given the structure of production, the state of technology and the available factors of production.[46] The sustainable input of the production factor labour is determined in part by the NAIRU (non-accelerating inflation rate of unemployment). A positive output gap means that the actual level of production exceeds the potential level, so that there is tension in the economy. The extent of the output gap depends on the rate of over- or under-capacity utilisation in production, as well as on the tightness in the labour market. A positive output gap can mean that actual production exceeds production capacity and/or that unemployment is smaller than the NAIRU.[47] A positive or negative output gap has no bearing on

[46] The level that can be sustained is below the maximum technically achievable production, when the available factors of production are utilised to the full. In real life, this full utilisation is not sustainable and not efficient. See Don (2001b).

[47] As will become apparent later on in this section, there is strictly speaking a third component, namely the cyclical component of the supply of labour. The contribution of this component to the output gap is generally less significant quantitatively, however, than the other two components.

the existence or otherwise of shortages in the goods or labour market. In 2002, for instance, the output gap was negative, whereas there were still shortages in the labour market. These were more than compensated for by the low capacity utilisation rate, however. The table below reflects the different situations in the labour and goods markets that can lead to a positive (+) or negative (−) output gap. Since the output gap is a macro indicator, significant bottlenecks in goods and labour sub-markets are also a possibility with an output gap of zero. A problem when

Table 2.3 Output gap in different situations on the goods and labour markets

	Goods and services market →		
Labour market ↓	High capacity utilisation	In equilibrium	Low capacity utilisation
tight ($u < nairu$)	+	+	+/−
in equilibrium	+	0	−
loose ($u > nairu$)	+/−	−	−

using concepts such as potential output, output gap and the NAIRU is that these are not observable variables. It follows that they have to be calculated, for which various methods (each with their individual pros and cons) may be applied. To determine potential growth and the related output gap, CPB uses what is known as the production function method, which is based on a CES production function. This method has been incorporated into SAFE as well. Section 2.4.2 describes the way in which potential growth is determined; section 2.4.4 deals with the output gap in more detail, and the NAIRU is considered in section 2.4.3.

Currently, potential output, the output gap and the NAIRU are still modelled as ‘loose ends’, that is to say that they do not play any part as explanatory variable in other model equations. The only exception to this is the output gap, which does play a role in determining the structural general government financial balance. This means that at present, not the difference with the NAIRU but the unemployment rate itself plays a role as tension indicator in the wage equation, and that the capacity utilisation rate, or the change in it, functions as tension indicator to determine price developments, among other things. It must still be investigated whether, in an empirical and theoretical sense, improvements would be achieved if these traditional tension indicators were replaced by, or added to, the output gap and the NAIRU.

2.4.2 Potential growth

In potential growth analyses, the emphasis is on the market sector. Potential output in the non-market sector has been equated to actual production.[48] By definition, potential GDP is equal to the aggregate of the market sector’s potential output and the non-market sector’s (potential)

[48] The non-market sector consists here of the public and health care sectors, mining and quarrying, and operation of real estate.

output. Also by definition, the market sector's potential output is equal to the product of that sector's potential employment and structural labour productivity.

$$yp^{ms} = ap^{ms} hs^{ms} \tag{2.42}$$

where:

yp^{ms} potential output, market sector

ap^{ms} potential employment, market sector (labour years)

hs^{ms} structural labour productivity, market sector

Potential employment in the market sector is determined by reducing the structural supply of labour (in labour years) by the NAIRU and by employment in the non-market sector.[49] When the NAIRU or employment in the non-market sector rises, the potential labour force available to the market sector shrinks. By definition, the structural supply of labour expressed in labour years is equal to the structural supply of labour expressed in terms of persons, divided by the structural p/a–ratio, that is the structural relationship between the number of people and the number of labour years.

$$ap^{ms} = \frac{asp}{pas}\left(1 - \frac{u^*}{100}\right) - a^{nms} \tag{2.43}$$

where:

ap^{ms} potential employment, market sector (labour years)

asp structural labour supply (persons)

pas structural equilibrium rate of unemployment p/a-ratio

u^* equilibrium rate of unemployment

a^{nms} employment, non-market sector (labour years)

Based on the estimated CES production function[50], structural labour productivity is determined by the total structural productivity factor (λv_l^*), the structural relationship between labour and capital, and working hours. The λ parameter was empirically estimated at 0.72 (see section 2.2.1).

$$\ln hs^{ms} = \lambda v_l^* + (1-\lambda)(\ln k - \ln ap^{ms}) + \lambda \ln d_l \tag{2.44}$$

where:

hs^{ms} structural labour productivity, market sector

v_l^* structural degree of labour-saving technical progress

[49] SAFE differentiates between structural or potential employment in the market sector determined by reference to the structural *supply* of labour in the economy, and the optimum (long-term) *demand* for labour determined by the production and relative labour costs in the market sector. See also section 2.2.1.

[50] See Draper et al. (2001).

k capital stock

ap^{ms} potential employment, market sector (labour years)

d_l working time of labour (hours per labour year)

In SAFE, progress in labour-saving techniques (v_l^*), working hours (d_l), the structural p/a-ratio (*pas*) and the structural labour supply (*asp*) are all exogenous, so that these variables are determined without making use of the model. Only the NAIRU still needs to be calculated in order to determine potential output.

2.4.3 NAIRU

The NAIRU is the level of unemployment after adjustment for one-off and cyclical factors, and the level towards which the economic adjustment processes tend to move. The level of the NAIRU depends on the wedge, the replacement rate and the relative capital costs.[51]

$$u^* = 0.21 \ln \Lambda_{541} + 0.34 \ln rp_{442} + 0.25(\ln p_k - \ln cy)_{4321} - 0.14 \qquad (2.45)$$

where:

u^* equilibrium rate of unemployment (NAIRU)

Λ wedge

Λ_{541} $= 0.5\Lambda + 0.4\Lambda_{-4} + 0.1\Lambda_{-8}$

rp replacement rate

rp_{442} $= 0.4rp + 0.4rp_{-4} + 0.2rp_{-8}$

p_k capital costs

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

x_{4321} $= 0.4x + 0.3x_{-4} + 0.2x_{-8} + 0.1x_{-12}$

This expression of the NAIRU projection is the result of interaction between wage negotiations, price setting and cost minimisation. The conclusion that may be drawn is that the NAIRU projection rises when the wedge[52], the replacement rate or the relative capital costs increase. A rise in the wedge or the replacement rate has an upward effect on the wage rate. In order to achieve the required return all the same, businesses cut down on the demand for labour, causing the NAIRU to rise. When the relative costs of capital go up, businesses wanting to keep the required return will have to cut down on labour costs, likewise resulting in less demand for labour and an increase in the NAIRU.

[51] See Broer et al. (2000). For a more detailed description of the projection results see Draper et al. (2001).

[52] The wedge is expressed in real terms and may be described as the quotient of the real cost of labour and real disposable wages. In SAFE, the wedge variable has been so modelled that only changes in it that result from adjustments to the tax and premium burden on wage income and changes in indirect tax rates, affect the NAIRU and the long-term wage rate (see section 2.3.3).

The time lag affecting the NAIRU differs per variable and, broadly speaking, amounts from six months to one year. The wedge and the replacement rate are largely policy-driven. Relative capitals costs on the other hand, affected as they are by the real rate of interest in particular, are hardly influenced by policy, but greatly affected by developments abroad. To determine the relative capital costs, the costs of capital (p_k) are related to the minimum costs per unit of product (*cy*). These are a function of the assumed cost minimisation of the cost function of the CES type (see section 2.2.1).

2.4.4 Output gap

An output gap occurs when actual market sector production varies from its potential level. The output gap incorporates the capacity utilisation rate and unemployment, being the traditional tension indicators of the goods and services market and the labour market respectively. Based on a CES production function and subject to the assumption that, for the stock of capital goods and for employment in the non-market sector, potential value is equal to actual value, the output gap may be re-written as follows:[53]

$$\begin{aligned} gap^{ms} &= \ln y^{ms} - \ln yp^{ms} = \ln y^{ms} - \ln yc^{ms} + \ln yc^{ms} - \ln yp^{ms} \\ &= \ln q^{ms} + \lambda(\ln a^{ms} - \ln ap^{ms}) \\ &\approx \ln q^{ms} + \lambda\left(\ln \frac{as}{pa} - \ln \frac{asp}{pas}\right) - \lambda(u - u^*) \end{aligned} \tag{2.46}$$

where:

gap^{ms}	output gap, market sector
yc^{ms}	production capacity, market sector
q^{ms}	rate of capacity utilisation(y/yc), market sector
as	labour supply (persons)
asp	structural labour supply (persons)
pa	p/a-ratio
pas	structural p/a-ratio
u	unemployment rate
u^*	equilibrium rate of unemployment (NAIRU)

It follows from this that in the market sector, the output gap consists of three components, namely the capacity utilisation rate, the cyclical component of the labour supply and the difference between actual unemployment and the NAIRU. This proposition clearly demonstrates that the output gap by no means has to be zero when unemployment is equal to the NAIRU. It

[53] For the sake of simplicity, this equation is written in a log-linear form. For a more detailed explanation, reference is made to Draper et al. (2001).

would be very coincidental indeed, if the two other components were to be zero at that moment, too, or if they were to nullify each other exactly.

As indicated earlier, there is an output gap for the market sector and one for the economy as a whole. The latter is the output gap normally published by CPB. This GDP output gap is equal to the percent difference between actual GDP and potential GDP. The latter is determined by adding the non-market sector's production to the market sector's potential production. This implies that in the non-market sector, the output gap is always assumed to equal zero.

$$gap = (y - yp)/(0.01yp) \tag{2.47}$$

$$yp \;\; = yp^{ms} + yn^{ms} \tag{2.48}$$

where:

gap	output gap GDP
y	gross value added (GDP)
yp	potential gross value added (GDP)
yp^{ms}	potential gross value added, market sector
yn^{ms}	gross value added, non-market sector

2.5 General government and pension funds

The general government comprises the central and local government (section 2.5.1), and the social security institutions (section 2.5.2). The revenues and expenditures of both are modelled. The tax and premium revenues of the general government, or the tax and premium burden, affect the income available for consumption, the wage rate and the rate of inflation (via VAT), among other things. General government consumption and investment form part of domestic expenditure, and income transfers influence household incomes. The general government financial balance or the EMU balance (section 2.5.3) is obtained by deducting expenditures from revenues. Separate attention is devoted to pension funds and life insurance companies (section 2.5.4), which do not form part of the general government.

While the general government block contains many equations, specifications have been kept relatively simple and are meant above all for the calculation of shocks. In SAFE, some small items from the National Accounts have been added to larger items for the sake of simplicity. When projections are made, most general government variables are supplied by CPB specialists. They make use of numerous detailed sub-models for taxes, premiums, income benefits, civil servant salaries, interest charges and natural gas revenues.

2.5.1 Government

In order to achieve a link with the industry-classification (classification by economic activity), the general government is also broken down in an alternative way: the government sector,

consisting of the units mainly engaged in characteristic government services (public administration, defence and, in the Netherlands, education), and the rest. The latter consist of sheltered workshops, municipal cleansing services, municipal health services, day shelters, centres for asylum seekers and university-linked institutions.

The different categories of government revenue included in SAFE are presented in table 2.4. The table shows that taxes on production are by far the largest source of government revenue. Taxes on production are determined by multiplying the output of domestically produced goods and services by their specific indirect tax rates. In addition, transfer taxes are regarded as a separate indirect tax category.

Table 2.4 Components of government revenues in SAFE (billion euro's)[a]

Category	Volume in 2001		Exogenous
Payroll tax	28.5		
on wage income		23.1	policy measures
on benefit income		5.4	policy measures
Direct taxes on profit income	22.8		
corporation tax (excl. on natural gas profits)		15.8	policy measures
corporation tax on natural gas profits		1.8	
income tax on households'profit income		5.2	
Taxes on production	57.9		policy measures and volume growth rate of transfer tax
Property income	10.1		
Property income (excl. from natural gas profits)		5.8	nominal level
non-tax revenues from natural gas exploration		4.2	
Net acquisition of non-produced assets (e.g. land and UMTS)	1.0		nominal level
Total of government revenues	120.3		

[a]The amounts do not exactly correspond with National Accounts figures, because for the sake of simplicity some minor items have been combined with larger items.

Direct taxes are sub-divided into payroll tax on wage and benefit income, and on profit income. For payroll-tax determination purposes, growth of the nominal tax base (wage and benefit income less premiums) has been divided into a volume and a price component. Volume growth of the payroll tax base for wage income is equal to the change in the number of wage earners, while for benefit income it is equal to the volume growth in the number of benefit and transfer income payments. Account is taken of the fact that the progression factor is higher for wage income than it is for benefit income. Inflation adjustment ensures that the tax progression is applicable only to the real increase in income. Tax on profit income consists of three components, namely corporation tax on profit income of businesses excluding natural gas profits, corporation tax on natural gas profits, and income tax on profit income of households.

Except for policy-induced changes, changes in the first-named component follow changes in profit income, reduced by the imputed gross wages of the self-employed and augmented by the interest charges of sectors liable to corporation tax. With some time lag, changes in corporation tax on natural gas profits follow the profit income in the mining and quarrying sector.[54] Income tax on the profit income of households is related in a complex manner to the profit income of sectors liable to income tax, account being taken of interest income and interest charges, and the net imputed wages of the self-employed.

Table 2.5 Components of net government expenditures (billion euro's)[a]

Category	Volume in 2001		Exogenous
Compensation of employees	43.4		volume growth rate[b]
Social benefits in kind (via market producers)	4.0		volume growth rate
Net government consumption of goods and services	24.4		
intermediate consumption		28.2	volume growth rate
sales (−/−)		14.4(−)	volume growth rate
consumption of fixed capital		10.6	volume growth rate
Government investment		14.5	volume growth rate
Subsidies	7.5		nominal level
Compensation of employees subsidies at the expense of social insurances	0.3 (−)		
Net income transfers to households	11.8		
unemployment benefits		4.2	partly volume growth rate
other income transfers to households		3.2	volume growth rate
Income transfers to non-profit institutions serving households		1.4	volume growth rate
child allowances		3.0	volume growth rate
Balance of capital transfers to firms	1.5		nominal level
Transfers and loans to foreign countries	4.9		
developing aid		3.2	% of national income
other transfers and loans to foreign countries		1.7	nominal level
Net income transfers to social security institutions	4.0		nominal level
Interest payments by the government	15.3		repayment of debt and corresponding interest
Contributions to the EU	2.6		
Administration costs of social security institutions (−/−)	2.3 (−)		
Consumption of fixed capital (−/−)	10.6(−)		volume growth rate
Statistical discrepancies	0.6 (−)		
Total of net government expenditures (transaction base)	120.0		

[a]The amounts do not exactly correspond with National Accounts figures, because for the sake of simplicity some minor items have been combined with larger items.

[b]Determined by employment and labour productivity growth in the general government.

[54] For determining the profit income in the mining and quarrying sector, SAFE contains rules of thumb for developments in the volume and price of the gross value added and for developments in the value of compensation of employees and depreciation in this sector. These rules of thumb are used only for the calculation of shocks.

The individual general government expenditure categories distinguished in SAFE are presented in table 2.5. The government spends most on compensation of employees. For most categories, changes in volume are exogenous. The lion's share of net transfer payments in respect of unemployment (ABW) is endogenous, however; the rule of thumb in question is that the change in the number of ABW payments amounts to 40% of the change in unemployment.

Wage rate developments in the general government are a weighted average of those in the government (0.82), business (0.12) and health care (0.06) sectors. Wage rate developments in the government sector are determined by developments in the contractual wage rate, incidental wages, and employers' social security contributions in that sector.

The contributions to the EU are a fixed percentage of taxes on production. Changes in the government's interest payments depend on its net borrowing in the capital market and the relevant interest rate. The amount of interest payments is also affected by refinancing of general government debt and the resulting interest rate differential. To determine the central and local governments' general financial balance, the social security institutions' investments and consumer expenditure (except for depreciation) are deducted first.

2.5.2 Social security

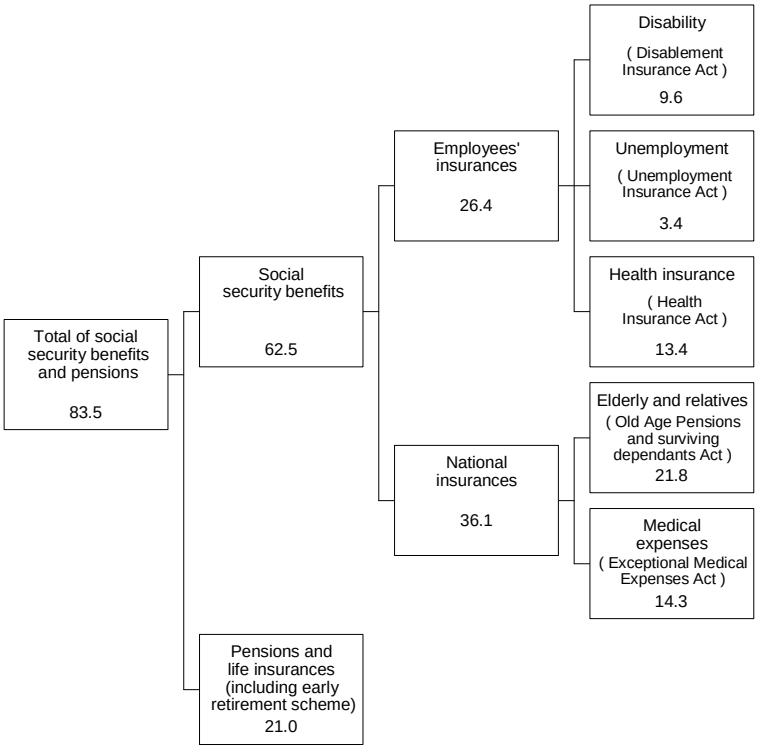
To make its projections, CPB uses a detailed social security model, called MOSI, in which institutional rules and regulations are modelled in detail. In the case of projections, the outcomes of the social security model are 'passed on' to SAFE. The equations of the social security block in SAFE are a mere simplification of those in the more detailed model, their primary purpose being to enable simulations to be calculated by SAFE autonomously, that is to say without making use of the detailed sub-model.

In the social security system, a distinction is made between employee insurance and national insurance. Although SAFE incorporates the possibility of determining premium rates on an endogenous basis (by means of rules of thumb[55]), the rates used in practice, which are supplied by the CPB specialists concerned on the basis of the most recent policy assumptions, are exogenous. This not only applies to the preparation of the central projection but to the calculation of simulations as well.

Social security is split into five benefit categories, namely benefits to the disabled, the unemployed, the sick, the elderly (older than 65 years) and surviving relatives, and for medical expenses. Except for the volume changes of unemployment benefits, all the other volume changes in the model are exogenous. The rule of thumb in the model for the number of

[55] The rules of thumb assume that premiums are cost-effective. This means that the premiums are equal to the net charges, i.e. the disbursements (benefits paid, consumption in kind, administrative expenses and capital transfers to households), less revenues other than premiums (net income and capital transfers by the government and investment income).

Figure 2.7 Composition of social security benefits and pensions in SAFE (billion euro's, 2001)



unemployment benefits payments is that the change in this number is equal to 60% of the change in unemployment.

The composition of the group of persons in receipt of an unemployment benefit is of importance to determine the amount of these benefits. This is because the nominal changes in benefits to persons who have been unemployed for longer periods is institutionally linked to changes in the minimum wage, whereas benefits paid to persons who recently became unemployed are linked to developments in the market sector wage rate.[56] The extent of the other social security benefits paid is likewise linked institutionally to developments in the minimum wage and the market sector wage rate. Via regime dummies (see Appendix B), these linking mechanisms may be switched on or off.

2.5.3 General government financial balance and tax and premium burden

In the preceding sections, we discussed the general government's revenues and expenditures. The balance of the central and local governments' revenues and expenditures is the general

[56] The number of unemployment benefit payments (expressed in labour years) is therefore made up of two groups, namely those who were on benefit in the previous quarter and still are in the current quarter, referred as the 'hard core', and those who still worked in the previous quarter but are on benefit in the current quarter, known as the 'new entrants'. The number of unemployment benefit payments in both groups are a non-linear function of the unemployment rate and the development in employment (for employees).

government financial balance. If we add to this the financial balance of the social security institutions, the result is the general government financial balance, or the EMU balance.

$$EMU = SV^{ohd} + SV^{sv} \tag{2.49}$$

$$SV^{ohd} = T + ZR^{ohd} + IGL - XV^{tr} \tag{2.50}$$

where:

EMU	general government financial balance (EMU-balance)
SV^{ohd}	central and local governments' financial balance
SV^{sv}	financial balance of social security institutions
T	total tax revenues (see table 2.4)
ZR^{ohd}	investment revenues government sector (transaction base)
IGL	balance of acquisition and sale of land
XV^{tr}	total net government expenditures (see table 2.5)

In addition, central and local governments have net borrowing requirements arrived at by reducing their general financial balance by their net lending (such as loans to students), the balance of the shares bought and sold (such as the privatisation of state corporations) and by any discrepancies between transaction-based and actual (cash) revenues. The government's net borrowing requirement determines the number of money it withdraws from the capital market.

$$SF^{ohd} = SV^{ohd} - XKR^{ohd} - XR^{ohd} - X^{ktr} \tag{2.51}$$

where:

SF^{ohd}	government's net borrowing requirement
SV^{ohd}	general government financial balance (EMU-balance)
XKR^{ohd}	net granting of credit by the government
XR^{ohd}	balance of government's acquisitions and sales of shares
X^{ktr}	discrepancies between transaction-based and cash-based expenditures and revenues

One of the factors influencing the EMU balance is the state of the economy. Both the revenues and expenditures of the general government are sensitive to economic conditions. For this reason, an EMU balance adjusted for this cyclical component is calculated. CPB uses the output gap to this end. The rule of thumb is that every percentage point in the output gap with a time lag of nine months results in a GDP rise of 0.65%-point in the EMU balance.[57] In order to allow for this, this cyclical component is deducted from the actual EMU balance.

$$EMU^{s} = EMU - 0.65\,\mathrm{g}_{20}(gap) \tag{2.52}$$

[57] See also CPB (2002a), page 33.

where:

EMU^s structural EMU-balance

EMU general government financial balance (EMU-balance)

gap output gap GDP

The tax and premium burden is equal to total taxes and social security premiums (for employee and national insurance) expressed at market prices as a percentage of GDP.

$$cld = \frac{T + PR^{wv} + PR^{vv}}{YBM} 100 \tag{2.53}$$

where:

cld tax and premium burden

T total tax revenues (see table 2.4)

PR^{wv} employees' social security premiums

PR^{vv} national social security premiums

YBM gross domestic product (at market prices)

2.5.4 Pension funds

Pensions constitute a substantial part of household income and are therefore important when determining private consumption. Moreover, since pension premiums form part of the social security charges of employers and employees, they affect the wage rate. Unlike social security, which operates under a pay-as-you-go system, pension funds and life insurance companies use the full-funding method. The income of these funds and companies are made up of premiums, returns on investments and the (exogenous) balance of capital transfers by the government.

Premiums are levied on three income categories, namely the gross aggregate wages of businesses, the gross aggregate wages of the government and the imputed gross aggregate wages of the self-employed. For the first two of these income categories, a distinction is made between employers' and employees' premiums. The premium rates themselves are exogenous. Changes in the returns on investments depend on past financial balances and the returns achieved on them, which are linked via simple rules of thumb to the long-term rates of interest in the Netherlands, Germany and the United States.

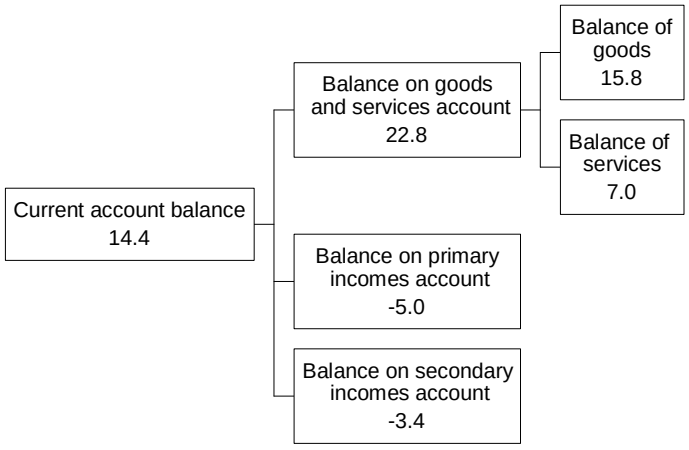
Apart from administrative expenses, the disbursements of pension funds and life insurance companies consist solely of pension, life insurance and early retirement benefits. Volume changes in the number of pension and other benefits (including early retirement) are exogenous. The change in the amount of pension and other benefits is linked to that in the contractual wage rate and the benefits paid to the elderly and relatives.

2.6 Other variables

2.6.1 Balance of payments

The surplus or deficit on the current account of the balance of payments reflects the results of the Netherlands' economic transactions with other countries. In the first place, these are the transactions resulting from the import and export of goods and services. In addition, the primary income flows are of importance; their modelling in SAFE is either exogenous or via simple rules of thumb. The income in question is the income obtained from the input of the labour and capital factors of production, such as the income resulting from Dutch investments abroad and those of non-residents in the Netherlands. Another aspect relates to the return on equity holdings, such as the distribution of dividends. The third and last component of the current account is the balance of secondary income, whose modelling is likewise exogenous or via simple rules of thumb. This income mainly relates to inter-governmental transfers, such as development aid and transfers to and by the European Union.

Figure 2.8 Current account balance of payments (billion euro's, 2001)



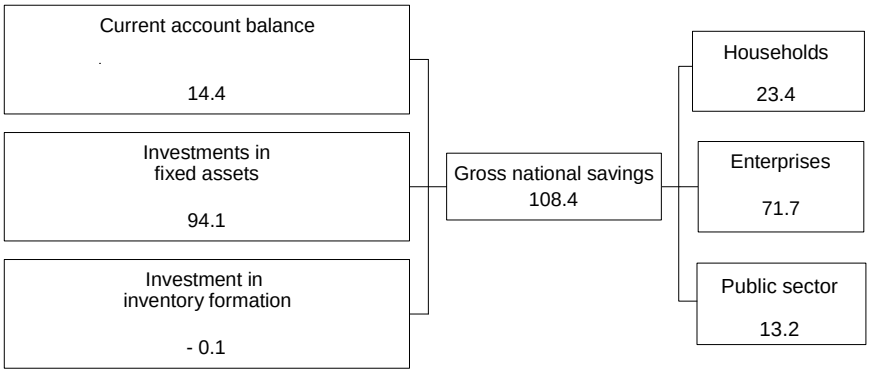
2.6.2 Savings

Aggregate (gross) domestic savings are equal to the current account balance of the balance of payments plus the total investments in fixed assets (business and government) and stock building. Net savings are the gross savings less depreciation. Total savings are the savings of households, businesses and the general government.

Household savings are equal to households' disposable income less private consumption. Business savings are made up of the profit income, net of corporation tax, less the profit income paid to households and plus contractual savings in the form of employers' premiums. Savings of the general government are then determined as a residual by deducting disbursements from

revenues.

Figure 2.9 Composition of gross national savings (billion euro's, 2001)



2.6.3 Labour share in enterprise income

The labour share in enterprise income is defined as aggregate wages (including wages imputed to the self-employed) divided by the net domestic product. It indicates what part of production accrues to the labour factor of production. The most common definition of labour share in enterprise income relates to the market sector, that is to say to businesses excluding the health care, mining and quarrying, and real estate sectors.

$$aiq^{ms} = \frac{(al^{ms} + az^{ms})p_l^{ms}}{YNF^{ms}} \tag{2.54}$$

where all variables refer to the market sector:

aiq	labour share in enterprise income
al	employees (labour years)
az	self-employed (labour years)
p_l	wage rate
YNF	net value added (at factor costs)

By splitting net domestic product into a volume and price component, it can simply be deduced that the percentage change in labour share of enterprise income is determined by the real change in wages and the development in labour productivity. It should be borne in mind, however, that we are concerned here with volume and price developments in the net, and not gross domestic product[58], as when determining changes in wages for instance.

[58] In analysing the absolute change in labour share in enterprise income, the percentage changes mentioned should be multiplied by the lagged level of labour share in enterprise income.

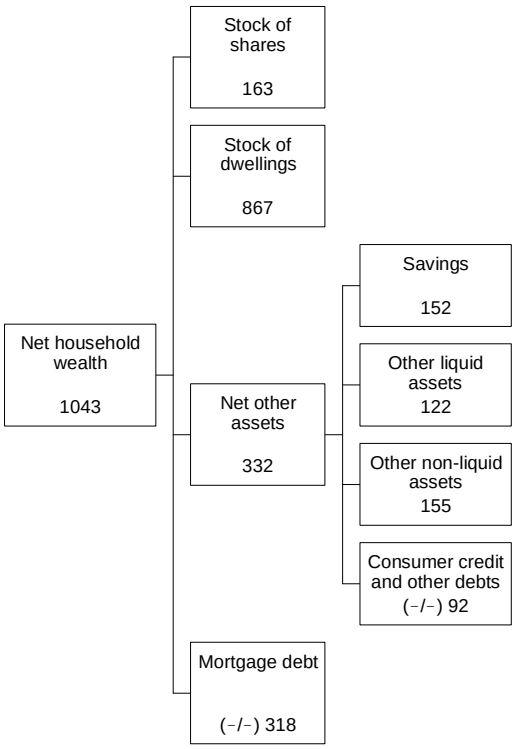
2.6.4 Wealth and equity

The wealth position of households and the equity position of businesses are significant factors in the economy. The equity of businesses determines the extent to which they are able to finance investments without borrowing, while the wealth of households has continued to gain in importance in recent years as a determinant of private consumption.

The equity of businesses is determined using the accounting identities in the balance sheet and profit-and-loss account. While this is done outside the SAFE model, the model's outcomes are used for many of the relevant items. The solvency of firms improves when fixed asset investments or tangible fixed assets are equity-financed.

Retained earnings are the principal source of finance for investments. Changes in businesses' retained earnings go hand in hand with changes in their income, which in turn is related to the capital share of income. This share is the complement of labour share in enterprise income (see section 2.6.3). Part of the profit is distributed to shareholders and part is retained. The parts are determined in such a way that changes in retained earnings are in line with market sector investments.[59]

Figure 2.10 Composition of net household wealth (billion euro's, 2001)



[59] For a detailed description of how the equity of businesses is determined, reference is made to Kusters (1994).

For the most part, the wealth of households is modelled explicitly in SAFE, however. Net households' wealth (excluding pension capital) is sub-divided into four components, namely the stock of dwellings owned, the stock of shares owned, net other assets and mortgage debt. Net other assets are a collection of items comprising savings and other liquid assets (cash, bank account balances and bonds), other non-liquid assets ('substantial share' stocks, business capital, land and other real estate), less consumer credit and other debts (see figure 2.10).

Capital accumulated by the payment of pension premiums is not included here. The background to this is that households are unable to dispose of these funds freely, and banks do not accept them as collateral security for loans either. The level of and change in household wealth have been modelled in SAFE as follows:

$$W_g = W_{g-1} + (\Delta W^{nov} + \Delta W^h + \Delta W^a - \Delta W^{hy})/4 \tag{2.55}$$

$$\Delta W^{nov} = YD^g - CO + OKG^g - 0.2IWE^{nt} \tag{2.56}$$

$$\Delta W^h = IWE^{nt} + 4W^h_{-1}\mathring{p}_{wh} \tag{2.57}$$

$$\Delta W^a = 4W_{a-1}\mathring{p}_{wa} \tag{2.58}$$

$$\Delta W^{hy} = 0.8IWE^{nt} + 0.35\,g_{13}[(\mathring{p}_{wh} - \mathring{p}_{cvl})W^h_{-1}] \tag{2.59}$$

where:

W_g	net households' wealth (excluding pension capital)
W^{nov}	net other households' assets
W^h	households' stock of dwellings
W^a	households' stock of shares
W^{hy}	households' mortgage debt
YD^g	disposable households' income
CO	private consumption
OKG^g	balance of capital transfers from government to households
IWE^{nt}	net investments in owner-occupied houses
p_{wh}	price of W^h
p_{wa}	price of W^a
p_{cvl}	price of private consumption (excluding fixed expenses)

The increase of the net other assets (ΔW^{nov}) is mainly determined by household savings, adjusted for the 20% part representing investment in houses purchased by households using their own funds. The stock of dwellings owned by households increases as a result of net investments

in owner-occupied houses and because existing houses increase in price.[60] The stock of shares increases when the value of shares owned by households goes up. In SAFE, the increase in value is exogenous.[61] Mortgage debts rise because 80% of the investment in owner-occupied houses is mortgage-financed, and because 35% of the increase in the value of the stock of dwellings households own is borrowed by them in the form of mortgages. In itself, the purchase of houses or shares does not result in a change in wealth since the increase in assets is offset by a similar increase in the debt position.

2.6.5 Consumption of fixed capital

Volume changes in business consumption of fixed capital are linked to the investments via a simple rule of thumb. Over the years, the depreciation parameter has increased, which is attributable to a greater portion of the stock of capital goods consisting of items such as computers, which are depreciated in a comparatively short period.

$$\mathring{d}^{be} = 0.0166 \left(\frac{IB}{D^{be}} \right)_{-1} \tag{2.60}$$

where:

d^{be} depreciation allowances of enterprises

IB private investment

SAFE incorporates the rule of thumb that, aside from autonomous variables, volume changes in the consumption of fixed capital of the constituent parts of the business sector (market sector, mining and quarrying, health care and operation of real estate) are equal to the volume change in the depreciation allowances of the business sector as a whole. The reasons for this rule of thumb include the need to calculate labour share in enterprise income.

Price changes in the depreciation rates of enterprises are a weighted average of the changes in the cost of investments in buildings, equipment, ground, civil engineering works, and houses.

[60] As a rule of thumb, price developments in existing owner-occupied houses are linked in SAFE to those in residential investments (excluding transfer duty). When central projections are prepared, use is made of the projections of the specialists concerned.

[61] When a central projection is computed, share prices are projected 'technically' and are approximately in line with the rate of inflation.

3 Shocks and scenarios

To give an impression of the operation of SAFE, nine standard shocks and two standard scenarios are described in this section. In a shock, an impulse is given to a single exogenous variable or autonomous variable, whereas a scenario outlines an alternative setting, international or otherwise. In this document, the standard scenarios concern changes in the euro rate and crude oil price, which are never isolated occurrences but can always be traced to a change in the international situation as a whole. An appreciation of the euro, for instance, will not only affect prices but relevant world trade and international rates of interest as well. The same applies to a rise in the price of crude oil. When making such international standard scenarios, the reasons for the change in the variable concerned are thoroughly weighed up and consistently programmed into various other international variables. This implies that when any change in the exchange rate or price of crude oil is attributed to other factors, it can have consequences for the specific composition of the impulse and hence for the outcomes of the model. When considered from this angle, the presented scenarios are less ‘standard’ than the shocks.

The exact outcomes of the shocks and scenarios depend on the underlying central projection and the SAFE model version used. The simulations set out below were calculated with the SAFE model version used for the Macroeconomic Outlook 2003. The central projection that was applied dates back to September 2002. Owing to the short-term nature of SAFE, only the effects up to and including the third year are presented. In addition, model outcomes are affected by the value of the regime dummies, since these cause specific linking mechanisms in the model to be switched on or off. Appendix B lists the values used for these dummies.

The standard shocks are:

1. A 1% impulse in relevant world trade
2. A 1% impulse in autonomous wages
3. A 5% reduction in the minimum wage and income benefits
4. A reduction in payroll and income taxes by 1% of GDP
5. An increase in the general VAT rate of 1% of GDP
6. An increase in the public sector’s consumption of goods and services by 1% of GDP
7. An autonomous increase of 100 000 persons in the labour supply
8. A 20% rise in share prices
9. A 10% rise in home prices

The standard scenarios are:

1. A 5% increase in the rate of the euro

2. A 20% increase in the price of crude oil

3.1 A 1% impulse in relevant world trade

The first simulation shows the effects of a world trade impulse of 1%. This refers to growth in relevant world trade in the first year (2003) that is one percentage point higher than in the central projection. Unlike the international scenarios presented later, the shock has a rudimentary character, meaning that all other international variables (such as exchange rates, interest rates, competitor countries' export prices, import prices, and the investment ratio of foreign competitors) are all assumed unchanged.

Because of the increased demand by the part of world trade that is of relevance to Dutch businesses, exports rise and so does market sector production. In the first year, the percentage increase in exports (excluding energy) is virtually the same as that in world trade because, in the short term, downward effects are set off by upward effects. Downward effects are linked to the so-called "Zijlstra-effect" and the deterioration in price competitiveness, both of which are caused by the rise in the capacity utilisation rate. The upward effects are linked to the export mix, which is such that the demand for Dutch products increases relatively quickly and strongly when there is an upswing in the world economy, and to an improvement in the quality of the Dutch export mix compared with foreign competitors. After the first year, the downward effects are a little more pronounced than the upward effects, with the cumulative growth in exports showing a tendency to decline.

Consumption and especially investments increase as early as in the first year as well. Consumption is higher because real wages go up owing to higher labour productivity and lower unemployment. Investments expand due to the rise in production and the improvement in profitability. In each of the three years, GDP volume rises by some 0.3%-point on a cumulative basis.

The rise in production results in an increase in employment, which is still modest in the first year owing to the time required by employers to adjust their workforce. Employment keeps on rising in the second and third years, so that consumption, too, continues to increase in these two years. This increase in consumption is also linked to some further rise in real wages resulting from the gradual reduction in unemployment. Investment activity benefits in the second and third years from the first year's increase in production, but as against this, there is an adverse effect due to the deterioration in profitability in the first year. On balance, there is a further slight rise in investments in the second and third years.

The EMU balance improves due to the higher growth in production. This is attributable above all to higher tax revenues on the one hand, and lower social security benefits on the other.

Table 3.1 Effects of a 1% impulse in relevant world trade

		2003	2004	2005
Volumes				
Private consumption	%	0.1	0.2	0.3
Non-residential private investment	%	0.5	0.8	0.8
Residential investment	%	0.0	0.1	0.2
Exports of goods (excl. energy)	%	1.0	0.9	0.8
domestically produced exports of manufactures	%	0.9	0.8	0.7
reexports	%	1.0	1.0	1.0
Imports of goods	%	0.7	0.8	0.7
Gross domestic product	%	0.3	0.3	0.3
Production, market sector	%	0.4	0.4	0.4
Wages and prices				
Wage rate enterprises	%	0.3	0.4	0.6
Contractual wage rate, market sector	%	0.1	0.3	0.5
Price private consumption	%	0.1	0.1	0.2
Price exports of goods (excl. energy)	%	0.1	0.1	0.2
Price GDP	%	0.1	0.2	0.3
Miscellaneous				
Employment market sector (labour years)	%	0.1	0.3	0.3
Labour productivity, market sector	%	0.3	0.1	0.1
Unemployment rate	D	−0.1	−0.2	−0.2
Capacity utilisation rate, market sector	D	0.1	0.1	0.0
Labour share in enterprise income, market sector	D	−0.2	0.0	0.1
EMU-balance (% GDP)	D	0.1	0.2	0.2
Tax and premium burden (% GDP)	D	−0.1	0.0	0.0

% = level deviations from central projection in %, D = level deviations from central projection (absolute difference)

3.2 A 1% impulse in autonomous wages

Since wages in SAFE are endogenous, the simulation of a wage impulse has a different quality from that of an exogenous shock, such as higher world trade or lower tax rates. In order to analyse the consequences of higher or lower wages, an impulse is therefore given to the autonomous variable in the wage equation. In the simulation described here, we are concerned with an autonomous wage impulse of 1%. There are two versions of such an impulse, namely a non-recurring and a permanent wage impulse.[62]

In the first case - not shown here in the form of a table - the higher wage increase tapers off again in the course of time, because the structural wage determinants, such as the wedge or the replacement rate, do not alter permanently. Wages adapt in such a way that in the long term, unemployment and all other variables revert to their original values in the central projection. Because the error correction model in the short-term wage equation is relatively high (0.85), this process of adjustment completes reasonably quickly. The cumulative effect on the contractual wage rate, for instance, reverts to zero in the fourth year, which means that by then wages will be at the same level again as in the central projection.

The wage shock shown in table 3.2 is an autonomous, permanent wage increase of 1%. This wage increase comes on top of the endogenous change in wages where, according to SAFE, in the long term the wage rate depends on the wedge, the replacement rate, the unemployment rate, the price level and labour productivity. Such an extra wage increase could be triggered by an institutional change that permanently affects the negotiating position of employers and employees. This could occur in a labour market that has become more flexible as a result of a change in the dismissal legislation, or as a result of fewer legal restrictions to temporary contracts of employment.

In calculating the consequences of the permanent wage impulse, it has been assumed that the increase in the contractual wage rate in the general government is of the same magnitude as that in the market sector. Wage-related income benefits, the minimum wage and the general government’s contractual wage rate, too, are all directly affected since it has been assumed that all the linking mechanisms concerned apply. This means that wage-related income benefits and the minimum wage will increase with some delay by the same percentage as the average increase in.

The permanent wage impulse results in a higher price rise, which in turn pushes up the increase in wages further. Private consumption is given a boost by the improvement in the purchasing power of wage earners and income benefit recipients. On the other hand, exports shrink owing to the deterioration in price competitiveness and a drop in investments due to

[62] In the case of a non-recurring wage impulse, only the autonomous variable is modified in the short-term wage equation, whereas in the case of a permanent impulse, the autonomous variable is modified in the long-term equation as well.

declining profitability. In the first year, the positive and negative effects cancel each other out and production in the market stays the same on balance. Yet, employment drops from the start due to the increase in real labour costs on the one hand, and the decline in the profitability of production on the other. In the first year, therefore, labour productivity in the market sector shows an increase. In the second and third years, there is a further contraction in exports and investments, which overshadows the positive effect of private consumption. For production in the market sector, the consequences of a permanent wage increase are accordingly adverse on balance after the first year. The effects on the EMU balance become apparent only after some time. In the first three years, the change in the EMU balance is hardly noticeable, only to deteriorate in the following years by 0.1 to 0.2%-point of GDP.

Table 3.2 Effects of a 1% impulse in autonomous wages

		2003	2004	2005
Volumes				
Private consumption	%	0.4	0.7	0.9
Non-residential private investment	%	−0.1	−0.3	−0.5
Residential investment	%	0.1	0.3	0.6
Exports of Goods (excl. energy)	%	−0.2	−0.4	−0.6
domestically produced exports of manufactures	%	−0.3	−0.8	−1.0
reexports	%	0.0	−0.1	−0.1
Imports of goods	%	0.0	0.1	0.1
Gross domestic product	%	0.0	0.0	0.0
Production, market sector	%	0.0	−0.1	−0.2
Wages and prices				
Wage rate enterprises	%	1.6	2.2	2.3
Contractual wage rate, market sector	%	1.6	2.2	2.4
Price private consumption	%	0.3	0.6	0.7
Price exports of goods (excl. energy)	%	0.3	0.5	0.5
Price GDP	%	0.7	1.2	1.3
Miscellaneous				
Employment market sector (labour years)	%	−0.2	−0.3	−0.5
Labour productivity, market sector	%	0.2	0.2	0.3
Unemployment rate	D	0.1	0.2	0.3
Capacity utilisation rate, market sector	D	0.0	0.0	0.0
Labour share in enterprise income, market sector	D	0.6	0.5	0.4
EMU-balance (% GDP)	D	0.0	0.0	0.0
Tax and premium burden (% GDP)	D	0.1	0.2	0.2

% = relative difference, D = absolute difference

3.3 A 5% reduction in the minimum wage and income benefits

In this simulation, the minimum wage and social security benefits are lowered autonomously by 5%. The result is a drop in the purchasing power of those on income benefit, which adversely affects consumption. In addition, this measure results in lower labour costs, because a reduction in income benefits means a decrease in the replacement rate.[63] This puts pressure on the increase in the contractual wage rate because such a decrease in the replacement rate implies deterioration in dismissed workers' fallback position.

The induced moderation in the contractual wage rate results in some decline in the purchasing power of wage earners. It stands to reason that the loss of purchasing power of people on income benefit is significantly greater, bearing in mind that the link between benefits and wages has been severed autonomously. The erosion in purchasing power of wage earners likewise results in a decrease in consumption. On the other hand, the lower labour costs enable an increase in exports, albeit with some time lag. In the first three years, market sector production is somewhat lower on balance than in the central projection. Yet, market sector employment remains stable because the drop in real labour costs and the improvement in profitability compensate for the lower production.

[63] The lower income benefits do not result in lower social security premiums, because fixed social security premium rates are used in SAFE.

Table 3.3 Effects of a 5% reduction in the minimum wage and income benefits

		2003	2004	2005
Volumes				
Private consumption	%	−0.3	−0.4	−0.5
Non-residential private investment	%	−0.1	−0.2	−0.1
Residential investment	%	0.0	−0.1	−0.2
Exports of Goods (excl. energy)	%	0.0	0.1	0.1
domestically produced exports of manufactures	%	0.1	0.2	0.3
reexports	%	0.0	0.0	0.0
Imports of goods	%	−0.1	−0.1	−0.1
Gross domestic product	%	−0.1	−0.1	−0.1
Production, market sector	%	−0.1	−0.1	−0.1
Wages and prices				
Wage rate enterprises	%	−0.3	−0.5	−0.6
Contractual wage rate, market sector	%	−0.2	−0.4	−0.6
Price private consumption	%	−0.1	−0.1	−0.2
Price exports of goods (excl. energy)	%	0.0	−0.1	−0.1
Price GDP	%	−0.1	−0.2	−0.3
Miscellaneous				
Employment market sector (labour years)	%	0.0	0.0	0.0
Labour productivity, market sector	%	−0.1	−0.1	−0.1
Unemployment rate	D	0.0	0.0	0.0
Capacity utilisation rate, market sector	D	0.0	0.0	0.0
Labour share in enterprise income, market sector	D	0.0	−0.1	−0.1
EMU-balance (% GDP)	D	0.2	0.2	0.2
Tax and premium burden (% GDP)	D	−0.1	−0.1	−0.1

% = relative difference, D = absolute difference

3.4 A reduction in payroll and income taxes by 1% of GDP

The effects of a reduction in payroll and income taxes are explained by means of a shock in which these taxes are reduced ex ante by 1% of GDP. This lower tax and premium burden puts pressure on the contractual wage rate. The beneficial effect of this lower burden on the purchasing power of households translates into increased consumption, resulting in a rise in market sector production in the first year. A significant part of the increase in consumer demand finds its way abroad via imports. Investments, too, rise in the first year owing to the increase in production and the improvement in profitability. Exports grow slightly. The beneficial effect of the improvement in price competitiveness is dampened by the adverse effect resulting from the increase in the capacity utilisation rate. Employment, too, shows an increase but reacts to production with some time lag, so that this increase does not match that of production in the first year.

In the second and third years, there is a further rise in production. Part of this is the result of increased exports because of sluggish improvement in price competitiveness in the first year but its continued improvement in the second and third years. Noteworthy, too, is that there is a further rise in consumption, bearing in mind that part of the gain in purchasing power brought about by the tax cuts in the first year, only results in higher spending in the second year. Investments, too, contribute to further growth in production. While the increase in investment is attributable in part to the growth in production, it is also linked to the time it takes for the improvement in profitability to take effect.

The EMU balance deteriorates due to the reduction in payroll and income taxes. Owing to the positive secondary effects, this deterioration is slightly smaller than the ex ante cut in payroll and income taxes.

Table 3.4 Effects of a reduction in payroll and income taxes by 1% of GDP

		2003	2004	2005
Volumes				
Private consumption	%	0.7	0.9	0.9
Non-residential private investment	%	0.5	1.2	1.5
Residential investment	%	0.1	0.5	1.0
Exports of Goods (excl. energy)	%	0.1	0.2	0.3
domestically produced exports of manufactures	%	0.1	0.3	0.5
reexports	%	0.0	0.1	0.1
Imports of goods	%	0.3	0.5	0.5
Gross domestic product	%	0.3	0.5	0.6
Production, market sector	%	0.3	0.6	0.7
Wages and prices				
Wage rate enterprises	%	−0.8	−1.3	−1.4
Contractual wage rate, market sector	%	−0.9	−1.4	−1.5
Price private consumption	%	−0.2	−0.4	−0.4
Price exports of goods (excl. energy)	%	−0.1	−0.2	−0.3
Price GDP	%	−0.4	−0.7	−0.8
Miscellaneous				
Employment market sector (labour years)	%	0.1	0.5	0.8
Labour productivity, market sector	%	0.2	0.1	−0.1
Unemployment rate	D	−0.1	−0.3	−0.4
Capacity utilisation rate, market sector	D	0.1	0.1	0.1
Labour share in enterprise income, market sector	D	−0.6	−0.6	−0.4
EMU-balance (% GDP)	D	−0.8	−0.8	−0.7
Tax and premium burden (% GDP)	D	−1.0	−1.1	−1.0

% = relative difference, D = absolute difference

3.5 An increase in the general VAT rate of 1% of GDP

SAFE does not differentiate between the large numbers of taxes on production of various kinds. With a share of 55% in total taxes on production, Value Added Tax (VAT) is by far the largest contributor to this category of taxes. Neither VAT itself nor its high or low rate are individually distinguished in SAFE, so that the consequences of an increase in VAT revenues are simulated on the basis of a shock in which taxes on production are increased autonomously. This increase corresponds ex ante with 1% of GDP, which is equivalent to an increase in VAT revenue of more than 15%.

The higher VAT revenue results first in boosting the price rise of private consumption, which has an upward effect on the increase in the contractual wage rate. The level of income benefits, too, is affected upwards under the assumed link between wages and benefits. Purchasing power weakens, however, so that consumption falls. Investment activity, too, shrinks as a result of the decrease in production and the decline in profitability. In addition, exports are adversely affected by the deterioration in price competitiveness. In total, GDP volume shrinks in the first year by 0.2%-point.

In the second and third years, there is a further drop in production (including that in the market sector). Consumption, investment activity and exports all contribute to this.

The EMU balance improves due to the higher VAT revenue. The negative knock-on effects hamper this improvement, however.

Table 3.5 Effects of an increase in the general VAT rate of 1% of GDP

		2003	2004	2005
Volumes				
Private consumption	%	−0.4	−0.6	−0.7
Non-residential private investment	%	−0.6	−1.3	−1.5
Residential investment	%	0.0	−0.3	−0.6
Exports of Goods (excl. energy)	%	−0.1	−0.2	−0.3
domestically produced exports of manufactures	%	−0.2	−0.4	−0.5
reexports	%	0.0	0.0	0.0
Imports of goods	%	−0.2	−0.4	−0.4
Gross domestic product	%	−0.2	−0.4	−0.5
Production, market sector	%	−0.3	−0.5	−0.6
Wages and prices				
Wage rate enterprises	%	0.7	0.8	0.7
Contractual wage rate, market sector	%	0.7	0.9	0.8
Price private consumption	%	1.4	1.5	1.5
Price exports of goods (excl. energy)	%	0.2	0.3	0.2
Price GDP	%	1.3	1.6	1.6
Miscellaneous				
Employment market sector (labour years)	%	−0.1	−0.4	−0.6
Labour productivity, market sector	%	−0.2	−0.1	0.0
Unemployment rate	D	0.1	0.2	0.4
Capacity utilisation rate, market sector	D	−0.1	−0.1	−0.1
Labour share in enterprise income, market sector	D	0.6	0.4	0.2
EMU-balance (% GDP)	D	0.7	0.6	0.6
Tax and premium burden (% GDP)	D	0.5	0.6	0.6

% = relative difference, D = absolute difference

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

The simulation in which the general government's consumption of goods and services is shown to expand is likewise based on an impulse amounting ex ante to 1% of GDP. Such a boost in expenditure triggers an increase in market sector production. Employment rises as a result, albeit with some delay. The decrease in unemployment causes a higher rise in the contractual wage rate. The incidental wage increases go up, too, owing to the fall in unemployment and the increase in labour productivity. The greater increase in wages and employment boosts private consumption. The rise in production and the improvement in profitability in the first year mean that investments, too, are benefiting. Exports, on the other hand, decline due to the deterioration in price competitiveness and the higher capacity utilisation rate. Price competitiveness deteriorates because the boost in wage increases and higher capacity utilisation rate result in higher inflation.

The increase in the general government's consumption of goods and services causes the EMU balance to deteriorate. The positive secondary effects, keep the decrease in the balance at less than 1% of GDP.

Table 3.6 Effects of an increase in the general government's consumption of goods and services by 1% of GDP

		2003	2004	2005
Volumes				
Private consumption	%	0.2	0.5	0.8
Non-residential private investment	%	1.3	2.0	1.8
Residential investment	%	0.0	0.2	0.6
Exports of Goods (excl. energy)	%	−0.2	−0.4	−0.5
domestically produced exports of manufactures	%	−0.3	−0.7	−0.9
reexports	%	0.0	0.0	−0.1
Imports of goods	%	0.5	0.6	0.6
Gross domestic product	%	0.9	0.9	0.9
Production, market sector	%	1.0	1.0	0.9
Wages and prices				
Wage rate enterprises	%	0.6	1.1	1.9
Contractual wage rate, market sector	%	0.4	0.9	1.6
Price private consumption	%	0.1	0.3	0.5
Price exports of goods (excl. energy)	%	0.1	0.3	0.5
Price GDP	%	0.2	0.6	1.0
Miscellaneous				
Employment market sector (labour years)	%	0.2	0.8	0.8
Labour productivity, market sector	%	0.8	0.2	0.2
Unemployment rate	D	−0.3	−0.6	−0.5
Capacity utilisation rate, market sector	D	0.3	0.2	0.1
Labour share in enterprise income, market sector	D	−0.5	0.1	0.4
EMU-balance (% GDP)	D	−0.8	−0.6	−0.6
Tax and premium burden (% GDP)	D	−0.1	0.1	0.2

% = relative difference, D = absolute difference

3.7 An autonomous increase of 100 000 persons in the labour supply

Initially, the effect of an increase in the labour supply is virtually entirely confined to an increase in unemployed jobseekers. An increase in unemployment has a depressing effect on wage developments, and this boosts the demand for labour, albeit gradually. In due course, owing to the high rate of unemployment in particular, but also to a decrease in real disposable incomes, some people withdraw from the labour market, thus reducing the labour supply.

Wage moderation translates into lower prices, so that competitiveness improves. Export volumes rise and imports shrink, while the demand for consumer goods falls slightly. The increase in the number of people with an income does not seem to compensate for the decline in the individual real disposable income of people holding down a job or on benefit. Overall, production rises, especially in the market sector. The higher rate of growth goes hand in hand with additional investment triggered by the increase in production and improvement in profitability. The additional labour supply lowers the EMU balance by about 0.2% of GDP. Wage moderation depresses tax revenues. This is partly compensated, however, by an increase in the number of taxpayers, as well as by higher income from corporation taxes. Initially, general government expenditure is affected by the increase in transfer payments due to the higher rate of unemployment. In the following years, these extra disbursements taper off and the lower total wage bill of the civil service begins to make a greater impact.

Table 3.7 Effects of an autonomous increase of 100 000 persons in the labour supply

		2003	2004	2005
Volumes				
Private consumption	%	0.3	0.0	−0.6
Non-residential private investment	%	0.1	0.4	0.8
Residential investment	%	0.0	0.0	−0.3
Exports of Goods (excl. energy)	%	0.0	0.2	0.6
domestically produced exports of manufactures	%	0.0	0.3	1.0
reexports	%	0.0	0.1	0.1
Imports of goods	%	0.1	0.1	0.0
Gross domestic product	%	0.1	0.1	0.1
Production, market sector	%	0.1	0.1	0.3
Wages and prices				
Wage rate enterprises	%	0.1	−1.9	−3.2
Contractual wage rate, market sector	%	0.0	−1.2	−2.7
Price private consumption	%	0.0	−0.4	−0.9
Price exports of goods (excl. energy)	%	0.0	−0.3	−0.7
Price GDP	%	0.0	−0.7	−1.6
Miscellaneous				
Employment market sector (labour years)	%	0.0	0.3	0.6
Labour productivity, market sector	%	0.1	−0.2	−0.3
Unemployment rate	D	1.1	0.8	0.6
Capacity utilisation rate, market sector	D	0.0	0.0	0.1
Labour share in enterprise income, market sector	D	−0.1	−0.9	−0.9
EMU-balance (% GDP)	D	−0.2	−0.2	−0.2
Tax and premium burden (% GDP)	D	0.1	−0.1	−0.2

% = relative difference, D = absolute difference

3.8 A 20% rise in share prices

A 20% rise in share prices (AEX) is likely to be worldwide, so that the shock should be combined with a boost in world trade. The effects of this are not considered here, however. In other words, we are concerned here with a rudimentary simulation that only shows the effect of wealth on private consumption and how it affects other variables.[64] Initially, the increased stock of shares has an upward effect on private consumption. In the first year, the rise in consumption attributable to this effect is limited to 0.1%, increasing to a cumulative 0.4% in the second and third years. Because of the time it takes for consumers to respond to changes in wealth, consumption rises above all in the second year. The positive effects on consumption translate into higher production volumes. Since consumer goods imports increase as well, the positive effect on GDP is limited. The higher rate of economic growth has a beneficial effect on business investment and, with some delay, there is an increase in employment as well. The decrease in the rate of unemployment pushes wage developments upwards. Boosted by the rise in the rate of employment and the higher adjustments to wages, private consumption shows a slight rise in the third year. After three years, the cumulative effect on GDP is 0.1%. The economic impact of a rise in AEX share prices is largely determined by the effect that changes in the stock of shares have on private consumption. The consumption equation described in section 2.2.2 underlies the outcomes of the model presented here. No account has therefore been taken of a more powerful or more rapid effect on consumption caused by changes in the stock of shares, as probably manifested itself in the first couple of years of this century when share prices plummeted. This more powerful and more rapid effect of downward adjustments in share prices is regarded as the exception rather than the rule.[65]

[64] For an example of a full share price simulation, reference is made to CPB (2002b), Macroeconomic Outlook 2003, page 20.

[65] In CPB (2002b), Macroeconomic Outlook 2003, section 3.1.2., the effect of falling share prices on private consumption is dealt with in more depth.

Table 3.8 Effects of a 20% rise in share prices

		2003	2004	2005
Volumes				
Private consumption	%	0.1	0.4	0.4
Non-residential private investment	%	0.0	0.2	0.3
Residential investment	%	0.0	0.0	0.0
Exports of Goods (excl. energy)	%	0.0	0.0	0.0
domestically produced exports of manufactures	%	0.0	−0.1	−0.1
reexports	%	0.0	0.0	0.0
Imports of goods	%	0.0	0.1	0.1
Gross domestic product	%	0.0	0.1	0.1
Production, market sector	%	0.0	0.1	0.1
Wages and prices				
Wage rate enterprises	%	0.0	0.1	0.1
Contractual wage rate, market sector	%	0.0	0.1	0.1
Price private consumption	%	0.0	0.0	0.0
Price exports of goods (excl. energy)	%	0.0	0.0	0.0
Price GDP	%	0.0	0.0	0.1
Miscellaneous				
Employment market sector (labour years)	%	0.0	0.0	0.1
Labour productivity, market sector	%	0.0	0.1	0.0
Unemployment rate	D	0.0	0.0	−0.1
Capacity utilisation rate, market sector	D	0.0	0.0	0.0
Labour share in enterprise income, market sector	D	0.0	−0.1	0.0
EMU-balance (% GDP)	D	0.0	0.1	0.1
Tax and premium burden (% GDP)	D	0.0	0.0	0.0

% = relative difference, D = absolute difference

3.9 A 10% rise in home prices

This simulation shows the effects of a 10% rise in home prices at the beginning of the year. Both the upward revaluation and increased level of the stock of dwellings owned by households have a beneficial effect on consumer spending in the first year. The increased consumption boosts production, resulting in increased investment activity as well (except for housing). Exports decline slightly, however, because the rise in the capacity utilisation rate adversely affects exports directly and indirectly via the upward pressure on the price levels of exports. In addition, under the influence of lower unemployment, the increase in wages, too, exerts upward pressure on export prices and so adversely affects price competitiveness. On balance, GDP goes up by 0.5% in the first year.

In the second year, there is a further slight rise in consumption. While the effect on consumption of revaluing the stock of dwellings owned by households has now disappeared, the effect on consumption of the increased level of this stock on the other hand, is manifesting itself for the most part only in the second year.

Table 3.9 Effects of a 10% rise in home prices

		2003	2004	2005
Volumes				
Private consumption	%	1.6	2.0	1.9
Non-residential private investment	%	0.7	1.4	1.2
Residential investment	%	0.0	0.1	0.3
Exports of Goods (excl. energy)	%	−0.1	−0.2	−0.3
domestically produced exports of manufactures	%	−0.1	−0.4	−0.5
reexports	%	0.0	0.0	0.0
Imports of goods	%	0.5	0.7	0.6
Gross domestic product	%	0.5	0.6	0.5
Production, market sector	%	0.6	0.6	0.5
Wages and prices				
Wage rate enterprises	%	0.3	0.7	1.0
Contractual wage rate, market sector	%	0.2	0.6	0.9
Price private consumption	%	0.1	0.2	0.2
Price exports of goods (excl. energy)	%	0.1	0.2	0.2
Price GDP	%	0.2	0.5	0.7
Miscellaneous				
Employment market sector (labour years)	%	0.1	0.5	0.5
Labour productivity, market sector	%	0.5	0.1	0.0
Unemployment rate	D	−0.1	−0.3	−0.3
Capacity utilisation rate, market sector	D	0.2	0.1	0.0
Labour share in enterprise income, market sector	D	−0.3	0.0	0.3
EMU-balance (% GDP)	D	0.3	0.4	0.4
Tax and premium burden (% GDP)	D	0.0	0.1	0.1

% = relative difference, D = absolute difference

3.10 A 5% increase in the rate of the euro

To illustrate the Dutch economy's sensitivity to the rate of the euro, a simulation has been calculated which assumes that, by reference to the central projection, the euro appreciates by 5% in relation to the US dollar as from the beginning of 2002. This shock assumes an appreciation of the euro of 2½% against the Japanese yen and the British pound. In the central projection that has been applied, the assumption is parity between the euro and the dollar for 2003-2005. The 5% appreciation of the euro against the US dollar as assumed in the shock implies that 1.05 dollar has to be paid for one euro.

The euro itself is not an exogenous variable in SAFE, so that the exogenous variables that are incorporated in the model have to be restated in terms of this euro appreciation. Firstly, these include all the Dutch import prices (including the price of crude oil) and competitor countries' export prices, which will decrease by different percentages in the simulation. The extent of the various price impulses depends on the extent to which imported products and the products of competitors originate from countries other than eurozone countries, or on the extent to which these imported products are traded in foreign currencies (mostly US dollars). Since the dollar is of greater importance to the imports of raw materials and semi-finished goods than it is to the imports of capital goods, the negative price impulse (in euro) of the first-named category is relatively significant.

In addition, an appreciation of the euro also affects relevant world trade and interest rates. Owing to the increase in the value of the euro, suppliers in eurozone countries see their competitiveness deteriorate. Economic activity accordingly slows down in the euro area and is stimulated outside it. Relatively speaking, Dutch exports focus strongly on European markets, resulting in lower growth of that part of world trade of relevance to the Netherlands. Lastly, inherent in this simulation is that the ECB will be less inclined to increase money market rates, because the danger of 'imported inflation' diminishes, and growth prospects for the euro area worsen slightly as well. In conjunction with this, the shock has a minor adverse effect on Dutch capital market interest rates as well.

The consequences of this shock for the Dutch economy are significant. The deterioration in price competitiveness results firstly in lower export growth. Since domestically produced exports are more price sensitive than reexports, the adverse effects of the erosion in price competitiveness depress domestically produced exports in particular. In the short term, consumption rises slightly because consumer prices fall more rapidly at first than do contractual wages. The lower production growth causes investment to decline. On balance, GDP volume contracts by some 0.3%-point on a cumulative basis in the second and third years. With some delay, employment, too, is affected by the lower growth in production. Owing to this delayed reaction, the rise in market sector labour productivity declines somewhat in the short term.

Aside from volume effects, there are nominal effects as well. Although it takes some time for

the lower import costs to be reflected in lower prices, the downward pressure on prices and its effect on wages are clearly visible, especially after the first year.

The general government's revenue and expenditure, too, are affected by the more costly euro. The biggest single contribution to the growth in expenditure comes from the increase in unemployment benefit payments. The drop in employment results in lower-than-expected revenue. In time, the EMU balance accordingly deteriorates by some 0.2%-point of GDP.

Model exercises by the OECD suggest that when compared to larger eurozone countries, the Dutch economy is relatively sensitive in the short term to changes in the euro-dollar exchange rate. This not only applies to production volumes but to the rate of inflation as well, so that the relatively significant effects on production, too, fade away sooner. This is due above all to the open nature of the Dutch economy.[66]

[66] A more in-depth examination of the Dutch economy's sensitivity to the US dollar may be found in section 3.3.5. of the Central Economic Plan 2002. See CPB (2002a).

Table 3.10 Effects of a 5% increase in the rate of the euro

		2003	2004	2005
International				
Relevant world trade, volume	%	−0.1	−0.2	−0.2
Price of competing exports (excl. energy)	%	−1.8	−2.1	−2.1
Import price of goods	%	−1.1	−1.4	−1.4
Import price crude oil	%	−3.0	−3.0	−3.0
Long-term interest rate	D	−0.1	−0.1	−0.1
Volumes				
Private consumption	%	0.1	0.0	−0.1
Non-residential private investment	%	−0.3	−0.7	−0.6
Residential investment	%	0.1	0.4	0.4
Exports of Goods (excl. energy)	%	−0.8	−0.9	−0.9
domestically produced exports of manufactures	%	−1.0	−1.1	−1.1
reexports	%	−0.6	−0.6	−0.6
Imports of goods	%	−0.4	−0.5	−0.5
Gross domestic product	%	−0.2	−0.3	−0.3
Production, market sector	%	−0.4	−0.5	−0.4
Wages and prices				
Wage rate enterprises	%	−0.3	−0.9	−1.5
Contractual wage rate, market sector	%	−0.2	−0.8	−1.3
Price private consumption	%	−0.3	−0.7	−0.9
Price exports of goods (excl. energy)	%	−0.8	−1.2	−1.4
Price GDP	%	−0.2	−0.8	−1.2
Miscellaneous				
Employment market sector (labour years)	%	−0.1	−0.3	−0.4
Labour productivity, market sector	%	−0.3	−0.2	−0.1
Unemployment rate	D	0.0	0.2	0.2
Capacity utilisation rate, market sector	D	−0.1	−0.1	0.0
Labour share in enterprise income, market sector	D	0.1	0.1	−0.1
EMU-balance (% GDP)	D	−0.1	−0.2	−0.2
Tax and premium burden (% GDP)	D	0.1	0.0	0.0

% = relative difference, D = absolute difference

3.11 A 20% increase in the price of crude oil

Measured in US dollars per barrel, the price of crude oil is a volatile variable. Under the influence of international developments, political or otherwise, the price of crude oil can fluctuate rapidly, up or down. This shock assumes a 20% rise in the price of crude oil. Such a substantial rise has adverse effects on worldwide economic development and pushes up the rate of inflation. In this scenario, it is assumed that growth in that part of world trade of relevance to the rate of growth in the Netherlands contracts by 0.3%-point in the first year and by 0.5%-point on a cumulative basis in the ensuing years. In addition, it has been assumed that under the impact of higher inflation worldwide, the rise in the price of crude oil goes hand in hand with an increase of 0.2%-point in long-term interest rates.

The higher price of crude oil translates into higher costs worldwide, and these filter through to selling prices, so that not only do the prices of imported energy products rise, so do the prices of other import components and of competitors. Via higher natural gas prices and higher costs, higher crude oil and import prices cause more severe inflation. The cost of the market sector's gross value added (hence without mining and quarrying) decreases in the first year, however, because the cost rises in this sector that go hand in hand with the higher price of crude oil cannot be passed on directly in the form of higher prices, and therefore have a negative effect on the terms of trade. In the second year, however, selling prices are adjusted for these cost increases, inflating the cost of value-added in the process. Owing to the weaker terms of trade in the first year, contractual wages do not keep pace with the higher rate of inflation, putting pressure on private consumption. Despite the lag in wage adjustment, labour share in the enterprise income of the market sector goes up significantly, which is likewise attributable to the effect of the weaker terms of trade. With some delay, employment adjusts to the lower production volumes. The EMU balance benefits from a rise in crude oil prices; non-tax revenues from natural gas grow substantially, its price shadowing that of crude oil, albeit with some delay. This unexpected boost in revenue is large enough to compensate for the lower-than-expected taxes due to lower economic growth and for the additional expenditure caused by the increase in unemployment.

Table 3.11 Effects of a 20% increase in the price of crude oil

		2003	2004	2005
International				
Relevant world trade, volume	%	−0.3	−0.5	−0.5
Price of competing exports (excl. energy)	%	0.4	0.7	0.7
Import price of goods	%	2.0	2.2	2.2
Import price crude oil	%	20.0	20.0	20.0
Long-term interest rate	D	0.2	0.2	0.2
Volumes				
Private consumption	%	−0.4	−0.7	−0.9
Non-residential private investment	%	−0.7	−1.5	−1.9
Residential investment	%	−0.2	−1.0	−1.5
Exports of Goods (excl. energy)	%	−0.3	−0.5	−0.6
domestically produced exports of manufactures	%	−0.3	−0.5	−0.6
reexports	%	−0.3	−0.6	−0.6
Imports of goods	%	−0.4	−0.9	−1.1
Gross domestic product	%	−0.2	−0.4	−0.5
Production, market sector	%	−0.3	−0.5	−0.6
Wages and prices				
Wage rate enterprises	%	−0.5	−0.5	−0.7
Contractual wage rate, market sector	%	−0.4	−0.4	−0.5
Price private consumption	%	0.2	0.5	0.6
Price exports of goods (excl. energy)	%	0.4	0.7	0.7
Price GDP	%	−0.2	0.2	0.2
Miscellaneous				
Employment market sector (labour years)	%	−0.1	−0.3	−0.6
Labour productivity, market sector	%	−0.2	−0.2	−0.1
Unemployment rate	D	0.0	0.2	0.3
Capacity utilisation rate, market sector	D	−0.1	−0.1	−0.1
Labour share in enterprise income, market sector	D	0.5	0.3	0.0
EMU-balance (% GDP)	D	0.0	0.0	0.0
Tax and premium burden (% GDP)	D	0.1	−0.1	−0.1

% = relative difference, D = absolute difference

Appendix A Overview of exogenous variables

Government

Effect of policy changes in fiscal and non-fiscal government instruments (e.g. several tax rates, subsidies, compensation of employees subsidies, investment tax credit rate, rate of inflation correction of tax brackets, change in corporation tax rate, non-tax revenues related to natural gas exploration); volume growth rates of respectively health care consumption, government consumption in kind, government's consumption of fixed capital, government investment, benefits in kind, supply of goods and services by the government; net acquisition of non-produced assets (e.g. land and UMTS) and other assets by the government; balance of capital transfers by the government; net income transfers by the government; discrepancies between transaction-based and cash-based expenditures and revenues; percentage of national income spend on developing aid.

Social security sector[67]

Volume growth rate of social security benefits (excluding related to unemployment); volume growth rate of payments related to pensions and life insurances; balance of intermediary payments between national insurances and employees' insurances; balance of capital transfers from social security institutions to households; premium rate for pensions and life insurances, premium rates of national and employees insurances (cash base); premium rate of Health insurance.

Energy[68]

Volume growth rate and price development of export of natural gas and other energy products; volume growth rate of domestic natural gas consumption; inventory formation of energy products (excluding natural gas); volume growth rate of investment in mining and quarrying sector; price development of gross value added in mining and quarrying sector; non-tax revenues of natural gas exploration.

Labour market

Changes in employment in non-market sector (mining and quarrying, real estate sector, health care sector), changes in government employment, change in structural labour supply, structural labour supply, (structural) p/a-ratio's, working time, change in number of self-employed,

[67] In practice, the endogenous premium rates for social insurances, in SAFE determined by rather simple thumbs of rule, are nowadays nearly always overruled by exogenous premium rates. Therefore these premium rates are listed in this section.

[68] Including natural gas variables which are strictly speaking endogenous, but which always have non-zero add factors and therefore are in fact exogenous.

incidental wage rate growth in public sector, labour productivity growth rate in government sector.

International

Volume growth rate relevant world trade (OECD countries's exports of goods excluding energy, doubly re-weighted), price development of competing exports of goods (excluding energy), investment ratio competing countries, several import price developments, long-term interest rates in Germany and U.S., short-term interest rate, government balance of income transfers to and from foreign countries.

Other exogenous variables

Rate of labour-saving technical progress, volume growth rate of investments in ships, aircraft and cattle), cumulated cost shares of several expenditure categories, volume growth rate and price development of residential services, regime dummies (see Appendix B).

Appendix B Regime dummies

Regime dummies enable specific SAFE linking mechanisms to be switched on or off. In all of these cases, the question is whether price developments of government-controlled variables should be linked or not. In central projections, such price developments are supplied as exogenous variables by the CPB specialists concerned, and regime dummies have no significance. On the other hand, whether these linking mechanisms apply or not may well affect the outcome of some simulations.

The table below shows the explanation and value of the regime dummies as incorporated in the current version of the model. Whenever a dummy has a value of one, the mechanism applies to the calculation of the standard simulations, and when this value is zero the mechanism does not apply.

Table B.1 Regime dummies in SAFE

Name	Meaning	Value in current version
Social security sector		
LMWBN___	link between the minimum wage rate growth and the average contractual wage rate growth (market sector, government and health care sector)	1
CS_BN___	link between the minimum wage rate growth and inflation	0
LMIBN___	link between nominal growth rate of benefits and that of the minimum wage rate	1
UKBBN___	link between nominal growth rate of child allowances and inflation	1
TORBN___	determines whether social security premiums paid by employees and self-employed are deductible for payroll taxes	1
Government		
LCMBN___	link between contractual wage rate growth in government and health care sector and that in the market sector	1
SF_BN___	determines the level of payroll tax needed to arrive at the target for government's net borrowing requirement	0
YBMBN_02	link between price deflator for government's ceilings (for expenditure and revenues) and price of GDP	1 since 2002
Energy		
CAGBNK__	link between price development of households' natural gas consumption and that of crude oil import price	0

Appendix C Time lag functions in SAFE

Table C.1 Overview of lag functions used in SAFE[a]

Nr.	a.l.	number of quarters											
		0	1	2	3	4	5	6	7	8	9	10	11
1	1.0	0.33	0.34	0.33									
2	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
3	2.0	0.2	0.2	0.2	0.2	0.2	0.2						
4	2.2	0.25	0.2	0.2	0.15	0.05	0.05	0.05	0.05				
5	2.3	0.1	0.2	0.3	0.2	0.1	0.1						
6	1.3	0.3	0.3	0.2	0.2								
7	0.4	0.6	0.4										
8	0.7	0.5	0.33	0.17									
9	1.5	0.125	0.375	0.375	0.125								
10	1.0	0.4	0.3	0.2	0.1								
11	5.1	0.03	0.06	0.09	0.12	0.14	0.14	0.12	0.1	0.08	0.06	0.04	0.02
12	2.2	0.23	0.2	0.17	0.14	0.11	0.08	0.05	0.02				
13	1.5	0.25	0.25	0.25	0.25								
14	1.1	0.25	0.5	0.2	0.05								
15	0.5	0.5	0.5										
16	0.5	0.6	0.3	0.1									
17	0.3	0.75	0.25										
18	3.0	0.05	0.2	0.2	0.2	0.15	0.1	0.05	0.05				
19	3.5	0.05	0.1	0.15	0.2	0.2	0.15	0.1	0.05				
20	1.3	0.25	0.375	0.25	0.125								
21	3.0	0.062	0.125	0.188	0.25	0.188	0.125	0.062					
22	4.1	0.15	0.13	0.11	0.1	0.09	0.08	0.08	0.07	0.07	0.06	0.04	0.02
23	2.5	0.15	0.2	0.2	0.15	0.15	0.1	0.05					
24	7.4	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.06	0.06[b]
25	0.0	1.0											
26	4.0	0.1	0.12	0.12	0.12	0.12	0.12	0.1	0.1	0.05	0.05		

[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.

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