Netherlands Scientific Council for
Government Policy

Scope for Growth

Threats to and opportunities for
the Dutch economy over the
next ten years

Summary of the twenty-ninth
Report to the Government

The Hague 1987

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1. INTRODUCTION

This report examines the conditions for achieving sustained economic growth while satisfying the objectives of economic policy. Although in this report economic growth is equated with growth in national income, a multi-dimensional concept of welfare is used covering not just national income but also employment, productivity, consumption and the quality of the environment. In addition the growth path is subject to additional requirements, such as equilibrium on the current account of the balance of payments and the prospect of equilibrium on the government account or at least an acceptably low deficit.

The central question in this respect is the extent to which the long-term recovery of the Dutch economy is threatened by conflicts between these requirements and objectives. Might for example a resumption of economic growth accentuate environmental problems to the point that economic growth finds itself curtailed again? Might an economic recovery impose such demands on the government sector that the government's objectives in relation to taxation and social insurance charges could not be attained? Or would a resumption of growth in fact facilitate the achievement of these requirements?

The question posed above is prompted by past experience. Apart from external disruptions, such as the collapse of the international monetary system and the two oil crises, economic growth was being endangered by conflicting economic aspirations in society. Thus the reverse suffered by the Dutch economy in the early 1970s may at least in part be attributed to the increasingly prevalent view at that time that economic growth could not be sustained on account of all the negative and largely unavoidable consequences for society. In particular it was feared that economic growth would adversely affect the environment to an even greater extent than the deterioration in the 1950s and 1960s that had become evident that time. Confidence in future growth prospects was undermined and a critical attitude arose in the Netherlands with respect to large-scale industrial and agricultural activities.

Other objectives also came into conflict with one another. During the 1960s and the early 1970s it was deliberately decided - with widespread support – to expand the public sector. Social security income transfers rose from 8.2% of net national income in 1960 to 18.5% in 1975, while the tax and social insurance contribution burden rose from 34.2% to 48.5%. Concern began to be expressed about this rise in 1975. In particular, it was feared that the growth of the private sector might lag behind consumers' preferences. The high priority attached by the government since then to reducing the share of the public sector and, subsequently, cutting back the deficit has on the one hand controlled the developments noted above, but has on the other increased uncertainty about the prospects for a sustained rise in living standards.

The Council sees evidence of continuing pessimism about the prospects for economic recovery. That pessimism would appear prompted by fears about the potential incompatibility of the various aspirations with respect to economic growth. Such fears even induce resistance towards growth-oriented policies; many people for example no longer desire growth if the environment cannot be properly protected. There is therefore more than enough reason for a study of the causes of those fears.

The stagnation of the 1970s and the early 1980s has left deep marks, not least with respect to the behaviour of consumers, employers, entrepreneurs and the government. Provided they are not too large and do not last too long, disruptions of the economic process lead to excess demand and excess supply. These can call forth forces that sometimes produce recovery, with the excesses providing the information needed by actors in the market to coordinate their responses. The disruptions of the 1970s and early 1980s were lengthy and serious, in consequence of which the forces for recovery were not stimulated and the information needed by actors in the market remained lacking. In the absence of possibilities for stimulating the demand for labour (e.g. by undercutting wages), consumers reduced their demand after

drawing on their reserves. In the longer term producers remained unable to realize their plans for the supply of goods, on which they had based their demand for labour and capital goods. The result was a fall in the demand for factors of production, including labour. In this way consumers and producers mutually confirmed the correctness and inevitability of their restrictive behaviour. The excess demand in the market for goods associated with the excess supply in the labour market disappeared, thus depriving entrepreneurs of the information they needed in order to respond adequately. The coordinating function of the market mechanism went astray and recovery failed to take place.

In the meantime the decline in economic activity led households and enterprises to draw on support from the government and the social security funds, while tax receipts were falling. The result was an increase in the public sector and the size of the government deficit. When the government sought to resist this trend, it also lapsed into restrictive behaviour.

Around 1981 and 1982 the Netherlands found itself in a situation of declining consumption and investment, stagnating exports and sharply rising unemployment. Inflation remained high and there appeared to be no prospects for a worthwhile increase in productive capacity and job creation. Private households saw themselves confronted with sustained unemployment and a decline or freeze in real income. Public investment was declining and the budget deficit rising. The balance of payments on current account was recording large surpluses, indicating a large financing surplus in the private sector. Capital exports were rising. As an instrument for distributing what was regarded as a constant volume of employment more fairly among all those wanting to work, job sharing was widely seen as a more important policy option than the encouragement of economic growth. Hardly any other options enjoyed real confidence.

Nevertheless the first signs of hesitant recovery may be discerned in these years, if only retrospectively. The share of profits in national income began to rise in 1981, a rise sustained in the succeeding years. Taken together with the fall in interest rates from 1981, this meant a gradual recovery in the return on capital. Since 1983 the recovery has manifested itself in a revival of exports. Investment followed after 1983: a growth of 15% in 1984, 12% in 1985 and over 8% in 1986. The volume of consumer expenditure began to rise again in 1985, as did the level of employment. Inflation disappeared. At this stage, however, it remains unclear whether the recovery will be sustained or will falter. Recent data indicate a fall in export growth in response to the decline in Dutch competitiveness in foreign markets. Similarly the rise in investment appears to be stagnating; although the business climate has improved appreciably, the behaviour of economic actors apparently remains conditioned by the recession and continues to show signs of risk-avoidance.

In 1983 the Council decided to investigate the conditions under which a self-sustaining process of economic growth might arise. In doing so the Council sought to base its study on a multi-dimensional concept of welfare in reasonably close accord with the preferences of the Dutch population. In the light of the situation as outlined above, the question then arose of the research design, the problem being that, as experience has shown, the turnaround from a marked depression or standstill to a resumption of economic growth requires autonomous impulses from both at home and abroad as well as radical changes in the behaviour of the actors in the market and the government. As has been seen, the forces for recovery are generated with extreme slowness (if at all) in a situation of stagnant economic growth, which makes it very difficult to describe the turning point and the first stage of the recovery. Autonomous impulses and changes in behaviour are not readily foreseen; nor is it understood how they arise. The reversal in the early 1980s was not predicted by economic advisers.

This report accordingly makes no predictions as to whether or not the fledgling recovery will be sustained. Instead long-term scenarios have been developed for alternative combinations of aspirations and objectives with respect to the growth paths. The objectives at issue are the growth in consumption, employment, value added, exports and productivity, as well as limiting the emission of environmental pollutants. Such scenarios indicate the extent to which conflicts between the various wishes and objectives can set limits on growth. They also indicate the conditions that need to be satisfied in order to realize the scenarios.

Scenarios may be developed with the aid of an optimization technique. In doing

so a set of acceptable economic developments is defined, from which those developments are then chosen that fit in best with the aspirations and objectives. The set is subject to a number of constraints laid down in the model. The selection of the set of acceptable developments, and hence of the model, is therefore of critical importance for the research.

Given the problem as defined by the Council, it would be undesirable to set prior limits on growth by making allowance for risk-avoiding and restrictive behaviour on the part of the economic actors; growth and recovery after all presuppose a radical change in such behaviour. A model should not therefore be chosen that includes provision for potentially disruptive behaviour. In seeking to identify the structural features of growth paths, it must be possible for those paths to emerge in the analysis rather than being ruled out at an early stage on account of behavioural variants not in fact relevant at that stage. A nascent recovery can for example be thwarted by sustained risk-avoidance on the part of entrepreneurs, which can in turn lead to an inadequate rise in investment. Since investment behaviour tends to be unpredictable, it is difficult to decide in advance whether allowance must be made for such an eventuality in a given situation. If an equation for the propensity to invest is included in the model, an optimization procedure in which growth potential is being identified will rapidly founder on the obstacles contained in that equation. In that case the growth paths would not even arise on paper, while the question of possible conflicts cannot even be posed.

The model must therefore be selected in such a way as to permit room for economic growth. It then becomes possible to examine whether (for example) an intensification of environmental problems will inhibit growth or whether problems in relation to government spending will in the long term necessitate a curb on growth.

Arrangement of the report

The Council has opted for an input-output model, supplemented by equations describing the emission of selected environmental pollutants as a function of sectoral production and consumption levels. Equations have also been included for the input of the labour and capital required in order to control such emissions. Investment has been related to the necessary level of productive capacity. With respect to the domestic and foreign demand for end products, margins have been introduced by setting upper and lower limits to the sectoral growth of consumption and exports, thus leaving room for the development of these categories of expenditure. Uncertainties with respect to the behaviour of consumers and exporters are in this way reflected in the spread of these margins. These aspects are taken up in more detail in Chapter 2.

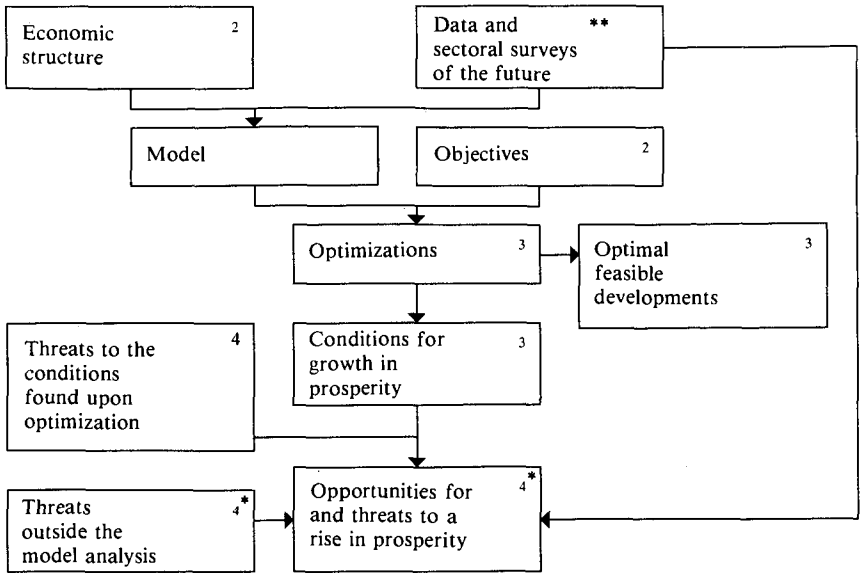
The economic structure and the data from the sectoral surveys of the future included in the second part of the Dutch report have been brought together in a core model, to which an optimization procedure has been applied following on the selection of a number of goal variables. In this way figures are obtained for the maximum attainable growth for individual objectives if those goals were pursued in isolation. A number of more balanced scenarios are also presented in which the simultaneous realization of the objectives is pursued, with varying emphases. The results provide insight not only into the extent to which the realization of the objectives is threatened because they are mutual contradictory, but also into potential obstacles inherent in the economic structure itself. A number of significant preconditions for the simultaneous realization of the various objectives may also be deduced from the results, specified according to sector and time. The results of this part of the study are contained in Chapter 3.

Chapter 4, which appears in highly condensed form in this translated version, examines whether factors not included in the model can also obstruct the type of sustained economic growth that fulfills the specified objectives. Taken as a whole, an impression is thus obtained of the opportunities for and threats to a rise in prosperity over the next ten years, while the quantified challenges facing the policies designed to achieve such growth may also be spelled out.

The quantitative specification of the model is explained in part two of the report (not included in this translated version). The data for this quantification are drawn from sectoral surveys specially carried out for the report.

The arrangement of the report is shown below in diagrammatic form. The figures refer to the chapters.

Figure 1.1: Arrangement of the report



* Included in highly condensed form only in this translation.
** Dutch version only.

2. MODEL AND METHOD

2.1 Introduction

The operation of the economic process and the decisive factors in its dynamics are generally acknowledged to be improperly understood. This means that caution is in order when it comes to the use of models in which the behaviour of the various economic actors is specified in some detail. For the purposes of preparing economic policy, the use of models of this kind contains the risk that certain interesting perspectives may be lost to sight.

Models of the behaviour of economic actors have become steadily more refined, without however doing much to solve questions surrounding the instability of the relationships and the potentially varying interpretations of the observations. The difficulty of specifying expectations – a crucial factor in the explanation of not only investment and consumption behaviour but also labour market behaviour – is illustrative in this respect. Particularly when there are numerous feedback mechanisms in the specification of the reaction equations, the models can become 'policy resistant', meaning that the results obtained by the model are barely susceptible to influence by the instrument variables. The margins for policy then appear very narrow: whatever policy options are examined, the problems remain unsolved.

As long as there is reasonable certainty about the relationships and the constancy of the parameters these limitations do not play a major role. Behavioural models also have their value in working out short-term effects for more changeable relationships. The picture changes, however, when it comes to research into possible developments over the somewhat longer term, when the danger arises that alternative developments and policy options may be prematurely lost to sight. Similarly, detailed behavioural models are less suitable for evaluating the consequences of policies expressly aimed at altering behavioural patterns (e.g. by means of non-quantifiable instruments). If, like the Council, one's concern is to survey the long-term prospects of the Dutch economy and if breaks in the trend are not to be ruled out in advance, this requires a different approach from models that are essentially based on trend extrapolation and in which behaviour is specified in some detail.

The following section examines the selection and use of models, with particular reference to policy preparation in the Netherlands. After examining the lack of consensus and the requirement of quantifiability, the section discusses the strategy adopted for this study. A description of the model is provided in section 2.3. The optimization technique is outlined in 2.4. Finally separate attention is devoted to the way in which the environmental issues have been taken into account in the model-based part of this study.

2.2 Theoretical preparation of economic policy

As noted in Chapter 1, the Council's research into the potential for consolidating economic recovery is based on an optimization technique. A technique of this kind means that goal (or objective, these terms will be used interchangeably in this report) functions are optimized subject to certain constraints relating to the margins within which the instruments of economic policy can be used and to the interdependencies between economic variables flowing from the behaviour of economic subjects. In addition the technical characteristics of the production process, the institutional framework within which the economic process takes place and the definitions laid down in the system of national accounts constitute parameters as well.

As soon as it becomes evident that not all the goals that have been set can be realized simultaneously with a given set of instruments, it becomes necessary to choose between the objectives or to review the judgement made about the

instruments used. These are subjective evaluations. On the other hand, the extent to which it is necessary to trade off goals against one another in order to achieve a higher level for a particular goal is determined by the interrelationships between the economic variables. The objective scope for trading off is enshrined in the model used in the preparation of economic policy. In fact the subjective willingness to make trade-offs is tested against the objective requirements imposed by the model on such a trade-off. In view of the multiplicity of models available, the important question arises as to the model used for optimization purposes.

For a long time, model selection was held to be purely a matter of economic theory, backed up by theoretical and empirical research. Further research would in due course lead to a general consensus as to what model was appropriate in what circumstances. This was not to rule out the possibility that new developments might at certain times lead to the use of new models. Fresh theoretical insights might arise, or improved and new statistical material might become available that affected the tenability of certain theoretical hypotheses. Nor did it mean that only one model would apply to (for example) the Dutch economy at a given point in time. There are models for the short, medium and long term. Similarly developments in economic theory over the past 20 years make it clear that account needs to be taken of the various stages of the trade cycle in constructing models.

Reviewing the 50-year period during which empirical models have been developed, it is difficult to avoid the impression that the intended result – the general acceptance of one or more models for a given economy – has not been achieved. Perhaps it was naive to expect that it might. At the present time radically different views of the functioning of the economic process exist side by side. Alternative interpretations of individual components of the economy are also available to model-builders. These alternatives can lead to significant differences in opinion about the interpretation of recent developments and policy options.

There is the additional complication that the behaviour of economic actors is not only variable, especially when viewed in the longer term, but also susceptible to influence by the general economic situation. This can lead to both secular and cyclical changes in that behaviour, which can sometimes – but not always – be included in the specification of the equations. Statistically, too, highly divergent values for the dependent variables can be compatible with the independent variables selected. The results of the model calculations could therefore be presented in the form of confidence intervals, within which the endogenous variables come to lie if the exogenous variables assume certain values. Exercises concerned with policy preparation generally do no more than specify that the results are uncertain. The way in which that uncertainty should be incorporated into policy decisions is unclear.

These observations are not new. In 1977 the Dutch economists Driehuis and Van der Zwan published a number of articles (e.g. in *Economisch Statistische Berichten*) in which they registered a marked degree of dissatisfaction with the way in which the VINTAF II model was being used by the Central Planning Bureau in the compilation of leading reports on the economic situation. The authors noted that the policy analyses were based on the use of a single model, with rather specific assumptions, when other model specifications were also available. The selection of a given model leads to certain interpretations of the factual situation and to certain policy recommendations; other models would lead to different interpretations and possibly to different economic policy recommendations [1].

In their reaction to the various contributions to the debate, Driehuis and Van der Zwan noted that in the theoretical refinement of models, not all individual behavioral hypotheses were testable. These refinements often relate to variables that have not (or not yet) been observed (e.g. heterogeneous capital goods stocks, available jobs) or are even not observable. This means that it is only possible to determine whether a complex of assumptions is acceptable in the light of actual developments. Conclusions essentially based on such refinements tend to lack empirical foundation. Claims to the effect that such refinements lead to superior interpretation or improved recommendations in the field of economic policy are accordingly difficult to defend [2].

Some of the reactions to the articles by Van der Zwan and Driehuis appear to underestimate the seriousness of the problem they identified. The same applies to a more recent discussion about the use of models in the preparation of economic

policy [3]. Even though econometric research is progressing, with new techniques being developed and new data being submitted, views on the functioning of the economic process continue to diverge widely.

The limiting requirement of quantifiability

In model-building, the description of the economic process is necessarily confined to quantifiable factors. The same clearly applies to the description of the instruments of economic policy. The model describes how these instruments influence the variables which, according to econometric research, determine the extent to which the objectives are achieved. Examples include tax rates, which affect the level of disposable income and hence consumer spending, tax allowances that affect investment behaviour, and so on. Non-quantifiable impulses are therefore left out of account. These might for example relate to measures that increase confidence in the stability of economic growth, or to measures to improve and supplement the market mechanism as an instrument for obtaining information on future relative scarcities, on the basis of which economic actors take decisions. Put more generally, there are a number of measures the effects of which serve to strengthen the economic structure but which are not capable of description by means of econometric models in terms of changes in selected explanatory variables. Such measures do, however, affect the behaviour of economic actors in the longer term, and hence the course of the economic process.

Export equations may be taken by way of example. Normally the growth of world trade and an index for competitiveness in foreign markets are regarded as the most important explanatory variables for the level of exports. Within that framework, instruments that affect wage trends and exchange rates can be examined for their influence on the achievement of the objectives. Other, more qualitative instruments, such as detailed information on the potential to penetrate foreign markets, brand familiarity abroad or the expansion of export credit insurance, are left out of consideration. In practice allowance is sometimes made for such factors by the introduction of autonomous terms into the equations in question. If these adjustments are substantial, however, they can have the effect of negating the entire equation.

If the potential created by the use of non-quantifiable instruments of this kind is to be ascertained and exploited with a view to improving the objectives, the behaviour to be influenced in this way needs to be allowed for in some manner other than the inclusion of behavioural relationships over which qualitative instruments have no hold.

A different approach

There are three reasons why the Council questions the efficacy for economic policy formulation purposes of exclusive reliance on econometric models with detailed behavioural equations.

1. The general validity of the behavioural relationships selected in a specific instance is too low to arrive at reliable conclusions with respect to the effectiveness of the instruments.
2. There are no ways of allowing for the fact that although a model uses *point* estimates for the endogenous variables, the econometric analysis on which the numerical specification of the equations is based only permits statements with any degree of reliability concerning the *interval* within which the values of those endogenous values will lie.
3. No allowance can be made for unquantifiable instruments in such models.

The uncertainty and problems surrounding the construction of economic models are well enough known among econometricians but do not, in the Council's view, get the attention they deserve when it comes to the usability of model results for policy preparation and implementation. If it is true that highly-detailed models can limit the room in policy preparation for other options in certain circumstances, the question arises as to whether there are methods of taking account of economic behaviour in some other manner in medium-term surveys of economic developments.

This report is based on a core model in which behavioural relations have been

replaced by constraints. The thinking behind this approach is that there is so little insight into economic behaviour that the value of the independent variables in a behavioural relation can be specified only in terms of intervals, which can be quite large. In the case of exports and domestic consumption, for example, minimum and maximum estimates only have been provided.

By taking the behaviour of economic actors into account in this way, room is created for developments that might otherwise be obscured by the built-in behavioural relations, but it then becomes necessary to examine whether those developments can arise spontaneously or need to be elicited by means of government policy. The absence of behavioural relations also prevents the effectiveness of potential policy measures from being measured - and rightly so, since, as has been seen, these relations have been left out precisely because there are doubts as to their universal validity. Policy recommendations based on the approach adopted in this study will accordingly be of a different nature from those that would have been obtained in a conventional analysis.

The approach in this report elaborates on a publication by J.A. Hartog et al.[4] and an initial application in this direction for the purposes of the Council's Policy-Oriented Survey of the Future [5], which has been reported on in a study by Van Driel et al.[6].

Goal variables have been added to the model relating to the next ten years. The model determines which combinations of goal variable values are feasible, i.e. a classification is made into permissible and impermissible combinations. The model does not, therefore, describe the complete economic process now or in the future but the margins within which goal variables are free to move. The fact that assumptions are made about economic relationships in setting limits to those margins is of less importance than the fact that the margins are not reduced to a single point, as would be the case if only one combination were possible for set values for the exogenous and instrument variables. Because the model simply defines a range, it does not produce clear-cut results. A large number of possibilities are left open, thus creating room for optimization.

The optimization process consists of choosing a permitted combination that is optimal for one of the target variables, i.e. as favourable as possible within the limiting conditions in relation to (i) other goals, (ii) the changes in the components of final demand used as 'instruments', and (iii) a number of variables that have to be kept within certain limits for more technical economic reasons. On account of the fact that all the relations used are linear, the optimal combination can be identified by linear programming. With a view to exploring the possibilities for the individual objectives the latter are to begin with separately optimized subject to fairly broad minimum conditions for the remaining goals. A matrix is then drawn up of the best feasible (individual) values and the least favourable values. This procedure is repeated several times subject to increasingly stringent restrictions for the goals [7]. This stepwise optimization procedure under restriction of the model produces three kinds of results:

a) consistent, technically feasible developments for the combination of target variable values deemed the most acceptable;
b) the 'price' of the restrictions imposed in terms of the formulated objectives;
c) a 'translation' of the objectives, e.g. the maximization of employment, in terms of requirements with respect to investment, domestic sales, exports and so on.

Point a) is particularly relevant for the systematic and purposive delimitation of the various conceivable lines of development. The results obtained under b) can help identify (technical) sticking points and the mutual price of conflicting objectives. Finally the results obtained under c) can form the starting point for an analysis of a much broader socio-economic field, as taken up in Chapter 4.

2.3 The model

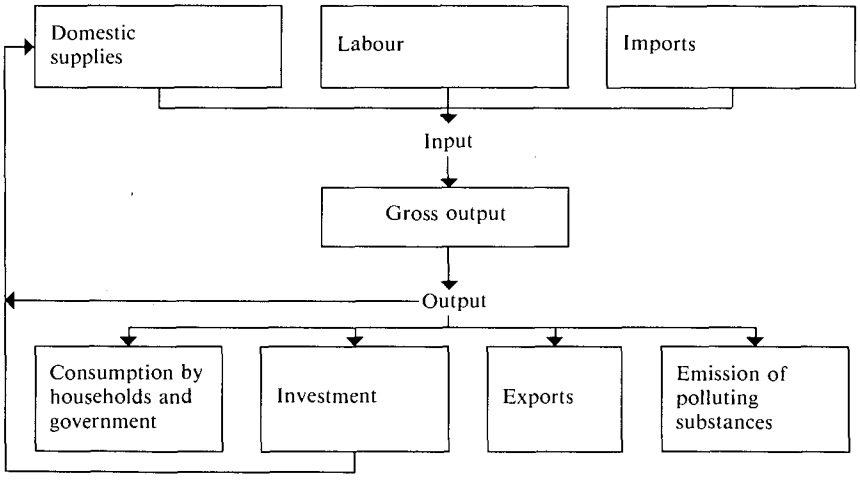
The research method used in this report consists on the one hand of a set of relations between variables and on the other of an optimization method. Apart from sectoral variables (for the sectoral breakdown, see Annex 1) such as production, production capacity, consumption, employment and exports there are variables at macro-level for which special requirements can be formulated, such as unemployment, the balance of trade, environmental pollution, the productivity of

labour or consumption. These goal variables can then be optimized, i.e. maximized or minimized, within the set of relations. The model used is described in this section, while the optimization method is discussed in the following section. The statistical foundation of the report is described in part II of the Dutch version of the report, which provides an account of the data used and the surveys made of the various sectors.

The set of relations, filled out with statistical material, constitutes the model. The relations describe the production and distribution process in the Dutch economy and the input and output of the various sectors. Within this framework, on the output side everything produced in a particular sector is necessarily used in the same or other sectors, consumed by households or exported. Emission of polluting substances may also occur. On the input side, the production and distribution process is based on the use of labour, capital, inter-industry sales and imported goods.

The input-output relations within this framework may be illustrated by means of the agricultural sector. Maize is produced and used within the agricultural sector itself as animal fodder. Other products are produced in this sector for processing by the foodstuffs industry. Agricultural products are also supplied direct to consumers and to other countries. Certain sectors also supply final products that serve as capital goods for other sectors; the metal processing industry, for example, produces agricultural machinery.

Figure 2.1: Input and output



The framework used for the model is an input-output matrix describing the transactions between the various sectors. In essence the input-output framework helps fulfil two kinds of requirements. In the first place there is the requirement that, as has been seen, everything produced in a sector is also sold. The possibilities of sales include supplies to other sectors or within the sector itself, deliveries of capital goods, deliveries to consumers, or exports. No account has been taken of changes in stocks.

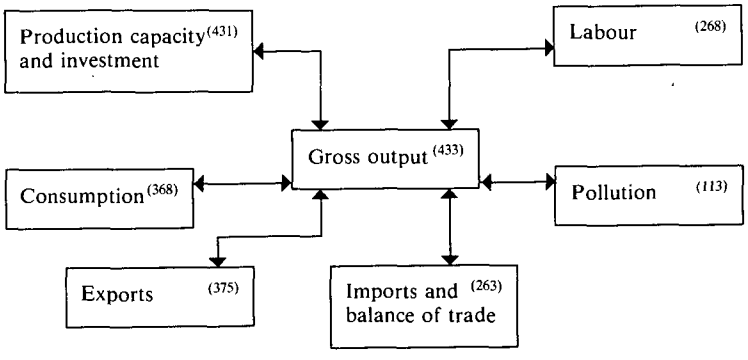
Secondly the requirement must be met that, according to technical relationships (the production functions) laid down in advance, the factors required to produce that output are available. These consist of imports of raw materials and semi-manufactures, inter-industry sales and labour and capital. These inter-industry sales are both input and output. In a dynamic input-output model of this kind, the same applies to domestically produced investment goods. Capital goods supplied in a given year are assumed to provide capital services in the following year for the recipient sector.

If the final demand (i.e. consumption, exports and deliveries of capital goods) per sector is given, the required level of labour, imports, investment and inter-industry sales can then be deduced. The calculation of these requirements is a traditional

application of input-output analysis. No fixed values for consumption and exports have, however, been selected in the present model; instead intervals have been specified within which they can move, thus providing room to examine potential future developments by means of optimizations.

An input-output relation needs to be included in the model for each sector of the economy in each year. The more sectors and years incorporated in the analysis, the greater the number of relations. The relations are shown in Figure 2.2.

Figure 2.2: Blocks distinguished in the model (number of relations in brackets)



For each block the variables are first defined. Upper and lower limits are then imposed for the annual changes in those variables in the projection period. These restrictions may be classified into four categories, ranging from objective to purely subjective.

Some of these restrictions are logical in nature, e.g. that gross output may not exceed productive capacity in any one sector in any one year. That capacity is itself dependent on the level of investment in preceding years and the rate of depreciation.

Other restrictions reflect assumptions about economic possibilities, e.g. the maximum and minimum growth of consumption or exports in different sectors. To begin with wide intervals may be set, but can later be reduced in line with what seems reasonable. These kinds of restrictions might be termed expectations, based on empirical experience, with an added element of evaluation.

Other types of restrictions that are specified in the model can be adjusted at will in line with political/strategic choices. One example would be the setting of restrictions to changes in certain types of consumption in line with the priorities of the policy-makers. These types of restrictions may be termed aspirations.

Finally there are restrictions that may be regarded as a reflection of what policy-makers intuitively regard as feasible e.g. a particular growth rate of national income. These types of restrictions, which are subjective, can to begin with be left out of account pending the results. If necessary they can still be imposed at a later stage.

Gross output

Gross output per sector is defined in terms of the production and distribution process described above. The input-output system centres around the value of gross output, i.e. the sum of the various output categories and at the same time the sum of the various inputs.

With respect to gross output per sector, the upper limit is logical in nature and is set by production capacity, while the lower limit avoids idle capacity: taken over the production period as a whole, at least a certain proportion of the production capacity in each sector must be used. The precise level is a matter of choice based on what appears desirable and plausible.

Production capacity and investment

The production capacity in each sector depends on the level of investment in preceding years. A distinction is drawn in the description between replacement and expansion investment.

The annual changes in capacity are subject to upper and lower limits. The lower limit implies no deliberate dismantlement of capacity, meaning that the production capacity may fall at a rate not exceeding the rate of depreciation of capital goods.

Moreover a lower limit is set for the decline in total capacity in the last projected year, thus preventing capacity from being dismantled for lack of a future perspective.

Exports

The upper and lower limits on the growth of exports may be varied in line with policy-makers' expectations and sales prospects abroad. The limits are expressed as a percentage of exports in the base year of the survey. The export volume of the Trade sector (meaning here not the value of the goods but the trading margins) is equal to a fixed ratio of the total exports of goods by all the other sectors.

Some sectors (e.g. Housing) do not export, while others have a more or less set export pattern based on long-term contracts (e.g. the Mining and Gas Distribution sector). In the latter case the margins are replaced by forecasts. Total average exports over the projection period is a goal variable.

Imports and balance of trade

Imports depend on the one hand on output and investment in the various sectors and on the other on the level and composition of consumption. The balance of trade is the difference between the imports and exports of goods and services. Upper and lower limits may be set to this balance that can be adjusted in line with political choices and with what appears plausible.

Consumption

The sale of goods and services to Dutch consumers is the third final output category (the others being investment and exports). The total volume of consumption (both domestically- produced and imported) over the next ten years is a goal variable. Imported consumer goods are assumed to be proportional to domestically-produced consumer goods, although the ratio can vary over time. Upper and lower limits are imposed on the annual change in domestically-produced consumption. The consumption of trade services is assumed to form a fixed ratio of the total consumption of goods.

Labour

Employment is a function of the level of production in the individual sectors. On account of differences in the level and trend of labour productivity, the relation varies per sector. It may, however, be assumed that the productivity of labour does not decline in any sector. In calculating the demand for labour account is taken of the fact that more is invested if production in a given sector increases rapidly thereby resulting in a rejuvenation of the capital goods and hence in higher labour productivity.

The upper limit to employment is the supply of labour less frictional unemployment. This may seem a strange requirement at a time of high unemployment, but since the results of the survey of future developments are not known in advance it is necessary for this logical constraint to be included. The lower limit for employment may be varied in accordance with policy priorities. The average employment over the projection period is a goal variable (see section 2.4).

Apart from employment the course of unemployment has also been included as a goal variable. The minimization of the average unemployment does not ensure a gradual decline in unemployment. For this reason a set trajectory has been formulated showing the desired gradual decline in unemployment to frictional

level. The minimization of the largest deviation in any one year from the desired trajectory has been taken as the goal variable.

Pollution

With respect to pollution a distinction has been drawn between potential acidification resulting from emissions of sulphur dioxide, nitrogen oxides and ammonia, and 'other pollution' expressed in terms of the costs of a number of proposed environmental measures. For both categories, emission coefficients have been included for all sectors enabling the pre-abatement level of pollution to be related to production and/or consumption of the goods and services produced in those sectors. In addition emission of polluting substances may take place independent of the level of production or consumption. Four separate pollution-control sectors have been included with a view to reducing potential acidification and 'other pollution'. Each of these sectors represents a set of specific measures of varying cost structure and effectiveness. Minimization of post-abatement pollution or rest pollution can be achieved by activating the pollution-abatement sectors, the reduction of production and/or consumption in sectors with high emission coefficients, or both. The environmental issue is taken up in more detail in section 2.5.

2.4 Optimization

The following questions can be answered with the model outlined above.

- Are the values desired for the goal variables technically feasible? Might even better values be possible?
- Looking at the goal variables in combination rather than separately, are those combinations technically possible? Is there room for improvement and, if so, where?
- What effect does a better value for a particular goal variable have on the best possible value for other variables? In other words, what is the price of a better value for one goal variable in terms of a deterioration of other goals.

These are strategic questions to which an answer can be given by means of optimization techniques, as initially applied in military operations and later also in industry.

These techniques have been applied in this study to macro-economic goal variables and environmental problems. To some extent, it is possible to formulate economic policy in terms of quantifiable goal variables, e.g. the aim of a certain rate of unemployment, a particular growth rate for consumption, a not excessive trade deficit, minimum pollution, etc. Deciding on the precise values for these variables or indicating the intervals within which they should lie of course reflects political choices. These questions can always be translated into strategic ones: a better value for one particular goal variable will often mean a worse value for another one.

The model exercises presented in Chapter 3 deal with seven different goal variables:

1. consumption (C);
2. demand for labour (L);
3. a goal variable for the level of unemployment (W), operationalized as the largest deviation in any year from a previously specified trajectory;
4. exports (E);
5. labour productivity (P);
6. unabated emission of potential acidification (Z);
7. unabated emissions of 'other pollution' (G).

With the exception of the third and fifth, all the goal variables relate to the average annual values for the projection period as a whole.

On the basis of these seven goal variables and using an input-output model, an interactive optimization method has been used (for a more detailed discussion see Annex 2, 'The interactive optimization of multiple goals'). This method consists of the following steps.

To begin with goal minimum restrictions are formulated for each of the goal

variables. A test is then conducted to see whether the economic system, in so far as described in the model, permits the realization of these minimum requirements in combination. This test could reveal that certain goal restrictions are incompatible, meaning that this initial step had been over-optimistic. If that is not the case, the goal restriction can then be tightened. This is done systematically, by tightening one restriction per round and then optimizing all the goal variables one by one, thus obtaining the best and worst values. An optimization round may be summarized as follows:

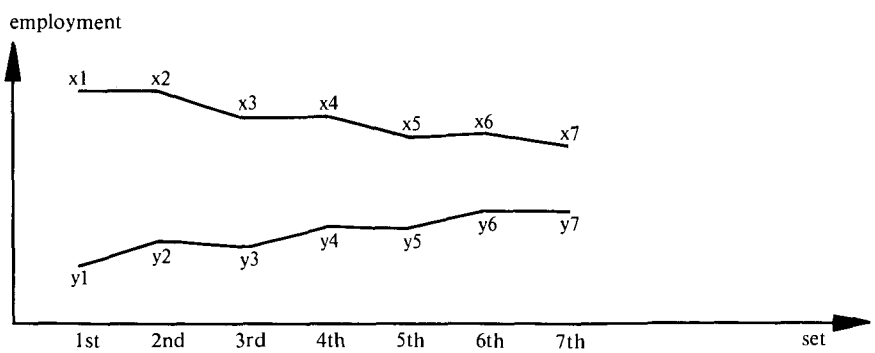
Table 2.1 Presentation of best and worst values per round

Goal variables	Worst (permitted) value	Inititial value in year zero	Results of the optimization of goal variables							Best and worst values
D1	g1	w1	b1	•	•	•	•	•	•	b1,s1
D2	g2	w2	•	b2	•	•	•	•	•	b2,s2
D3	g3	w3	•	•	b3	•	•	•	•	b3,s3
D4	g4	w4	•	•	•	b4	•	•	•	b4,s4
D5	g5	w5	•	•	•	•	b5	•	•	b5,s5
D6	g6	w6	•	•	•	•	•	b6	•	b6,s6
D7	g7	w7	•	•	•	•	•	•	b7	b7,s7
	↑ Selected	↑ Given	↑ Calculated							

The next step consists of examining how the goal variables affect one another, especially each other's 'best' values. It is not the optimization of a single variable that is of interest; the aim is to arrive at an acceptable whole or combination of goal variables, with the latter not too far from their optimal values. After a round of optimizations the goal restriction considered most unfavourable can be improved in a subsequent round. Once this has been carried out a fresh table can be compiled. A small change in the goal restrictions may prove to worsen the optimal value for another goal variable substantially. In this case a step back can be taken (partial or otherwise).

After effecting improvements to the goal restrictions for each of the seven goal variables, seven tables are obtained consisting of sets of best and worst values. To facilitate analysis these values are shown in graph form. Unemployment, for example, has the following best and worst values in the seven different sets of limits:

Figure 2.3: Development of worst and best values – an example



x_i = best value for employment in the i-th set of restrictions.
y_i = worst value for employment in the i-th set of restrictions

A similar diagram may be drawn for each of the goal variables. Upon each improvement of a goal restriction imposed on a goal variable, the maximum achievable values for the remaining goals will at best remain unchanged. The gap between the best and the worst values becomes smaller. In this way the room for possible future developments, which is still very large in the initial stages, is systematically explored and narrowed down.

2.5 Environmental issues

The model also enables insight to be obtained into the consequences of tackling a selection of environmental problems The basis for selection is provided by the structure of the model itself, in that it must be possible to establish a quantifiable relationship between the seriousness of the environmental problem in question and the variables used in the model. The selection of environmental problems included in the model has been confined to pollution resulting from emissions, not just of substances but also noise nuisance, radiation, and risks, etc. It is not possible to include environmental problems relating to land use as a result of consumption and production activities since the model lacks a regional breakdown.

Emissions

Before a particular form of pollution can be included in the model, it needs to comply with a number of conditions. As far as the generation of pollution is concerned, the model specification generally consists of one or more emission coefficients linked to the scale of the sectoral production or consumption activities. A self-evident condition is the requirement for sufficient data to arrive at reliable coefficients: for many substances the level of emission is simply not known, and these must accordingly be left out of account in the quantitative part of the model study.

A second precondition is that the emission should be roughly proportional to the scale of the sectoral production or consumption in order to use linear relationships per sector. A substance such as acrylonitrile, for example, originates from a few specific sources and should not therefore be simply related to the size of the Chemical sector in its totality. It is, however, possible for such emissions to be included in the model as exogeneous variables.

No coefficients for the emissions of individual substances have been included in the model since single-substance problems do not obstruct growth on a macro-economic scale. An exception in this respect could be CO_2. For the present, the only way of limiting CO_2 emissions is to impose drastic restrictions on the combustion of fossil fuels on a global scale, which would not appear a realistic prospect within the foreseeable future.

Two types of pollution that satisfy these preconditions have been included in the model. The first of these is the group of potentially acidifying substances: sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia (NH_3). The emission of these substances is expressed in the unit of acidification, mol H^{+8}. The second group is formed by pollution for which control measures have been taken up in the Indicative Multi-Year Environmental Control Programme (IMP-M) 1987-1991, an annually updated action plan issued by the Ministry of Housing, Physical Planning and Environmental Control. The content of this category of 'other pollution' is specified in Table 2.2. The emissions are expressed in the model in terms of pollution abatement costs (in guilders).

Table 2.2 Proposed measures to combat pollution included under the category of "other pollution"

Measure	Emission
1. Abating tri and per emissions by chemical laundries and the metal industry	trichlorethylene tetrachlorethylene
2. Abating vinyl chloride emissions by chemical industry	vinyl chloride
3. Cleaning up potato flour ind.	oxygen-binding substances
4. Cleaning up timber impregnation industry	creosote and heavy metals
5. Shipyard improvement	noise
6. Slaughterhouse improvement	oxygen-binding substances

7. Replacement of PCBs in transformers	PCB
8. Storage of radioactive waste	radiation
9. Installation of halogenated aromatics abatement plants	halogenated aromatics
10. Cleaning up car-wreckers' yards	oil, wrecks
11. Hospital waste disposal	hazardous waste
12. Rotterdam Port Reception Facility, including taking in residual cargoes and cleaning out tankers	various chemical compounds, oil and oil products
13. Collection of small chemical waste	various chemical compounds
14. Controlled dumping of waste	various substances
15. Storage of dredgings	chemical compounds, heavy metals, etc.
16. Soil decontamination	various substances
17. Noise abatement	noise

Source: TEBODIN, *Economische evaluatie van het milieubeleid* (Economic evaluation of environmental policy), Ministry of Housing, Physical Planning and Environmental Control, The Hague, 1986.
Indicatief Meerjaren Programma Milieubeheer 1987-1991 (Indicative Multi-Year Environmental Control Programme 1987-1991), Parliamentary papers, Lower House, 1986-1987 session, 19 707, nos. 1-2.

Pollution control

More radical pollution control than at present would be possible in many cases. Apart from the 18 traditional economic sectors, in which the current abatement activities have been included, four pollution-abatement sectors have been specified in the model. The ultimate pollution is taken as the gross emission, which is dependent on the level of activity in the various economic sectors, less the abatement carried out by the various pollution-abatement sectors. The latter sectors have been fitted into the customary input-output structure of the model, for which purpose the required import ratios and technical, capital, depreciation and labour coefficients have been calculated.

As regards *potentially acidifying emissions,* coefficients have been included for the relevant sectors expressing the relationship between the level of output and consumption and the emission of SO2 and/or NOx. The emission of ammonia has been included as an exogenous factor because this emission does not relate to the Agriculture sector as a whole but to livestock farming only. Three abatement sectors have been formulated in relation to acidification, thereby doing justice to the substantial difference in costs between the various control measures. The costs per mol H- avoided are specified for a number of representative methods in each sector, thus enabling the technical, capital, depreciation and labour coefficients as well as the import ratio to be calculated.

What this means for the 'cheap' abatement sector is shown in Table 2.3. The three measures taken as representative are the direct ploughing in and the injection of manure and the desulphurization of the flue gas from coal-fired power stations. No operating expenses are incurred in the case of ploughing in; the additional investment consists of the procurement of a special manure spreader. In the case of manure injection, labour and fuel are required in addition to an injector and a tractor. The data on flue gas desulphurization are taken from a report prepared by the Ministry of Housing, Physical Planning and Environmental Control and have been used to arrive at a division into average capital and operating costs.

Table 2.3 Specification of representative methods in the "cheap" acidification abatement sector (in guilders per abated 1,000 mol H^+)

Direct ploughing in of manure (total cost Fl. 12/1000 mol H^+)

Capital charges		12	(100%)
Investment		103	
of which:			
Metal-proc. ind.	103		

Coal-fired power station flue-gas desulphurization (total costs Fl.36/1000 mol H^+)

Capital charges		21	(58%)	Operating costs		15	(42%)
Investment		178		of which:			
of which:				Imports	2		
Imports	53			Labour	5		
Construction	36			Intermediate	8		
Metal-proc. ind.	89			of which:			
				Electricity	2		
				Chemicals	2		
				Petr. ind.	2		
				Min. & gas distrib.	2		

Grassland manure injection (total costs Fl.54/1000 mol H^+)

Capital charges		25	(47%)	Operating costs		29	(53%)
				of which:			
Investment		218		Labour	25		
of which:				Intermediate	4		
Imports	76			of which:			
Metal-proc. ind.	142			Petr. ind.	4		

Source: WRR, on basis of B.H. Tangena, *Optimalisatie bestrijding verzurende emissies* (Optimizing the Abatement of Acidifying Emissions), RIVM report no. 840568001, 1984.
Technical Advisory Committee, *Advies over zwaveldioxide* (Sulphur Dioxide Report), Ministry of Housing, Physical Planning and Environmental Control, Publication series "Lucht": no. 26, 1984

The total costs for the desulphurization of flue gas of Fl.36 per 1000 mol H^+ are split into Fl.21 interest and depreciation and Fl.15 operating costs per year. Given a rate of interest of 10% and an amortization period of 20 years, the interest and depreciation figure of Fl.21 per year amounts to an investment of Fl.178 distributed as follows: imported goods 30%, Construction Industry 20% and Metal-Processing Industry 50%. The operating costs are sub-divided into imports (among others manganous oxide), labour and intermediate supplies of electricity, sulphuric acid, oil, coke and limestone.

The costs per measure obtained in this way can next be converted into sectoral figures by averaging, with the share of the abated emission per measure acting as a weight. Two further acidification abatement sectors, with a higher cost per abated mol H^+, have been built up in an analogous manner.

The abatement measures are subject to two restrictions. First each of these sectors can only tackle a certain percentage of the unabated pollution. Secondly, a limit has been set to the annual increase in capacity in order to prevent an unrealistic expansion of the abatement sectors. The goal variable to be minimized is the level of post-abatement emissions, measured in mol H^+.

With respect to *other pollution* the summation is based on the costs per abatement measure. In the case of each measure an analysis is made to determine which sector is responsible for the emission to which that measure is directed. Where there are multiple sources an apportionment formula is used. Where no particular sector or sectors can be designated as the source, the emission is treated as an exogenous variable. Where the sector or sectors can be identified, a coefficient has been included so that the emission per sector can be shown in 'control guilders' per unit of output or consumption. This then enables pollution with highly divergent environmental effects to be aggregated and its control to be analysed in terms of

economic effects. As in the case of potentially acidifying emissions, this abatement sector has also been constructed on the basis of the abatement measures represented in it. Representative measures have not, however, been used in this sector; instead a breakdown into the various types of costs has been made for all the measures included. The eventual coefficients for the sector as a whole were obtained by averaging the costs per measure, with the share of the measures in question in abatement guilders in the sector used as a weight. Once again the goal variable is post-abatement emission, in this case expressed in 'abatement guilders'.

The inclusion of emission coefficients and abatement sectors enable the consequences of setting emission standards or the optimization of an environmental goal to be analysed. Post-abatement emission can be reduced in various ways: by a general reduction in the level of economic activity, by adjusting the sectoral structure, by the use of abatement sectors, or by combinations of these. Depending on the requirements specified for other goals, the model will arrive at varying choices.

Certain environmental problems are not effectively tackled by the setting of standards or by control, but only by direct limitations on production. With respect to the problem of eutrophication (enrichment) resulting from manure, for example, the model study assumes an upper limit to the number of animals in intensive animal husbandry. In conjunction with production controls in the dairy industry, this means a maximum increase in capacity for the Agriculture sector as a whole of 2.5% a year. In principle other limitations imposed on production, consumption or exports may be incorporated in the model in this manner.

It needs to be borne in mind that as a result of this approach – i.e. the inclusion of *categories* of potential acidification and other pollution – the model calculations do not produce any results that can be directly translated into environmental impact. It should also be emphasized that it was not possible for all environmental problems to be included in the model. Omitted for example are the greenhouse effect of the rising levels of CO2 in the atmosphere, the destruction of the ozone layer in the stratosphere, photochemical atmospheric pollution and environmental problems arising from physical planning decisions. Attention is paid to both these points in a more qualitative sense in the evaluation of the model results presented in Chapter 4.

1 See Driehuis and Van der Zwan, eds., *De voorbereiding van het economisch beleid kritisch bezien* (A Critical Appraisal of the Preparation of Economic Policy), Leiden/Antwerp, Stenfert Kroese, 1978, p. 24 ff.

2 Ibid., p. 170 ff.

3 See L. van der Geest, 'Een tijdbom onder de econometrie I en II' (A Time Bomb beneath Econometrics I and II), in *Economisch Statistische Berichten* of 24 August 1983 and 31 August 1983 and the reactions in ESB by Den Butter, V.J. de Jong et al., Cramer, Tinbergen, Kuipers, Van den Bosch, Nooteboom, Kloek, J. de Koning and J.A. Hartog in the period 9.11.1983-13.6.1984.

4 J.A. Hartog, G.J. van Driel and C. van Ravenzwaaij, *Limits to the Welfare State,* Boston, Martinus Nijhoff Publishing, 1980.

5 WRR, *Beleidsgerichte toekomstverkenning; deel 2: Een verruiming van perspectief* (A Policy-Oriented Survey of the Future: Towards a Broader Perspective); Report to the Government no. 25, The Hague, Staatsuitgeverij, 1983. English summary available.

6 Van Driel, Van Ravenzwaaij, Veeneklaas and Spronk, *Grenzen en mogelijkheden van het economisch stelsel in Nederland* (Limits and Potentials of the Economic System in the Netherlands), Preliminary and Background Study Series No. V40, WRR, The Hague, Staatsuitgeverij, 1983.
See also G.J. van Driel et al., 'Objectives and Potentials of the Dutch Economy in the Eighties', in *Macro-Economic Planning with Conflicting Goals,* Lecture Notes in Economics and Mathematical Systems no. 230, edited by M. Despontin, P. Nijkamp and J. Spronk, Berlin, Springer-Verlag, 1984.
J. Spronk, F.R. Veeneklaas, 'A Feasibility Study of Economic and Environmental Scenarios by means of Interactive Multiple Goal Programming', in *Regional Science and Urban Economics,* no. 13 (1983), North Holland, pp. 141-160.

7 For a diagrammatic representation and an example see Annex 2.

8 Multiplied by the molecular weight of the substance in question, the unit mol or gram-molecule indicates the number of grammes of the substance. With the aid of this unit the emissions of the various substances can be translated into emissions of the potentially acidifying ion H^+.

3. RESULTS OF THE OPTIMIZATIONS

3.1 Introduction

In dealing with the long-term growth prospects for an economy, the concept of the 'natural rate of growth' is often introduced. This rate of growth may be viewed as the ceiling that is set on economic growth by the availability of factors of production and the pace of technical progress, and may be equated to the growth of the labour force plus that of labour productivity. If factors of production are under-utilized, e.g. in times of unemployment, actual growth can – temporarily - exceed the natural rate of growth. With respect to the Netherlands in the period 1986-1995, the upper limit is in the region of 5% a year: approximately 0.5% growth in the supply of labour (measured in man-hours), plus over 1.5% growth by the absorption of unemployment, plus a rise in productivity per man-hour of 2-3%.

As discussed in section 2.3, upper limits need to be set in the model for the growth of consumption and exports. The maximum growth of the productive capacity of the Netherlands is also the limit for the long-term growth in income. On the basis of this factor and the varying income elasticities for the demand for the various products and services, upper limits have, to begin with, been formulated for domestic consumer demand. Much wider margins are, however, set for exports. This means that the maximum permitted level of consumption and the maximum permitted level of exports cannot be attained at the same time; given the upper limit imposed by the natural rate of growth, the productive capacity would be inadequate, at least in an average sense over the long term. For a brief period of one or a few years, however, it is possible for the natural rate of growth to be exceeded, e.g. by tapping a significant proportion of the unemployed workforce or if macro labour productivity rises more rapidly as the result of changes in the composition of production.

The first step in the model analysis concentrates on whether, within the limits set by the model, the macro-economic natural rate of growth is approached given the full utilization of economic capacity. If not, it needs to be shown why such a rate of growth is considered unfeasible from the very outset. If on the other hand the natural rate of growth is approached in the initial calculations – i.e. before setting any requirements with respect to specific goals – it is interesting to examine the associated structure of demand. By the latter is meant not just the breakdown into the three major categories of demand, namely consumption, exports and investment, but also the sectoral breakdown within those categories.

The maximum utilization of economic capacity is simulated by maximizing employment throughout the projection period without imposing binding restrictions on the other goals. The results may be found in section 3.2 below, 'An employment scenario'. The best attainable values for the other goals, again viewed separately, is described in section 3.3, 'The scope for the realization of the individual goals'. Section 3.4 then discusses the trade-off between the various goals, i.e. the price paid when various objectives are pursued simultaneously. To this end the initial room is systematically narrowed by the step-by-step improvement of the most unfavourable permitted goal values. The room finally left if binding goal restrictions are simultaneously imposed on various objectives is called the 'balanced growth area'. The resulting development when the volume of consumption is maximized within this area is the subject of special consideration in section 3.5, 'A balanced growth scenario'. The conditions for achieving such a result – in so far as they can be identified in the model – are also discussed in more detail in this section. In the concluding section, a number of variants are presented that indicate the consequences of a failure to comply with particular conditions. The balanced growth scenario and these variants in turn form the starting point for a discussion in Chapter 4, which seeks to do justice to a number of relations and factors that could not be incorporated in the model.

3.2 An employment scenario [1]

In order to test whether, and if so how, a scenario is possible in which the productive capacity of the Dutch economy can be fully utilized, employment is maximized over the projection period. No requirements are for the time being imposed on other goals. This results in a growth rate for the gross output (i.e. value added plus inter-industry sales and imports of raw materials and semi-manufactured goods) of 4.8% a year and an average annual increase in employment of 100,000 man-years or 2%. (As in the rest of this report, employment is expressed in man-years with the same average working hours as those in 1985). The growth in employment is concentrated mainly in the period 1988-1993. From 1993 onwards the supply of labour forms the limiting factor to a further growth in employment.

These results mean that the restrictions incorporated in the model do not prevent the natural rate of growth from being approached. They also reveal that the initial economic structure as described in the model permits high growth rates for both production and employment. This is not something to be assumed as a matter of course; there have been cases of prospective input-output studies in other countries that suggested from the outset that obstacles to growth were unavoidable short of structural changes [2]. In such cases, the economic structure - i.e. the relationship between the various industries and with other countries, as well as between production and the input of factors of production – impedes steady growth. This conclusion does not, then, apply to the present economic structure of the Netherlands.

Apart from the general question of the attainability of the theoretical maximum, the question of the breakdown of the expenditure entailed is also relevant. That breakdown shifts heavily in favour of investment (which should grow at 9% a year), with consumption lagging behind. Exports grow somewhat more rapidly than the value of production. The investment ratio - i.e. gross investment as a proportion of gross value added - therefore increases, from 17% in 1985 to an average of over 22% in the projection period. The largest rise in the average level of investment (more than a doubling in relation to 1985) takes place in the manufacturing sectors of Chemicals, Metal-Processing, Foodstuffs and Other Industry and the services sectors of Trade, Consumer Services, Transport and Communications and Business Services (for the sectoral classification see Annex 1). In this respect it needs to be borne in mind that a constant level of investment in housing has been assumed.

The export growth of 5.5% a year needs to be realized by vigorous export growth in the Metal-Processing industry, Electrotechnical industry, Chemicals and Other Industry and in tertiary services, especially Transport and Communications.

The composition of consumption does not display a structural shift in favour of services. The supply of basic needs (foodstuffs, fuel and housing) rises by around 3% a year, and the consumption of industrial goods and commercial services (excluding housing) by around 5%. At nearly 2% a year, the consumption of non-profit services is lower, with much of this growth being attributable to a growth of over 4% in health care (non-profit services consist of the sectors of Health Care, Education and Public Administration and Defence).

It needs to be borne in mind that all values are expressed in 1983 prices. The estimated composition of consumption in 1995 therefore provides only an impression of the breakdown of the consumption package in *volume* terms; the budgetary shares of the various categories of consumption can, and indeed are likely to, turn out differently as the result of relative price changes.

This scenario has opted for the maximization of employment in order to analyse a situation in which productive capacity is utilized to the full. The latter could also have been simulated by the maximization of value added over the projection period. In this case the growth in gross output is 0.2% point higher, since the model then comes to be based on a somewhat different structure of production in which the productivity of labour is slightly higher. In terms of investment ratios, output structure or employment the results obtained with this simulation differ only marginally from those presented above. This is an indication that the values in question are of a largely imperative nature when it comes to approaching the macro-economic upper limit to growth.

3.3 The scope for the realization of the individual goals

Table 3.1 provides a survey of the maximum achievable values for the goal variables (the diagonal elements), the values assumed in that case by the other goal variables and the associated rates of growth for a number of macro-economic variables. The goal constraints have been selected in such a manner as not to be binding. The columns thus indicate which values are achievable and under what circumstances if an individual goal is pursued single-mindedly.

Table 3.1 Goal variable values under individual optimalization (average for the projection period[a]), constant prices)

Goal variables	Unit	Restriction	1985 value	(1) Max! C	(2) Max! L	(3) Min! W	(4) Max! E	(5) Max! P	(6) Min! Z	(7) Min! G
(1) Consumption (C)	Fl. billion	≥0	285	**365**	352	357	343	331	293	312
(2) Employment (L)	1000 man-y.	≥0	4561	4866	**5117**	5100	5019	4750	3814	4395
(3) Largest deviation from target unemploym. path (W)	1000 man-y.	≤3000		701	207	**176**	343	805	2515	1187
(4) Exports (E)	Fl. billion	≥0	229	264	308	302	**321**	311	181	230
(5) Productivity (P)[b]		≥0	0	22,6	27,6	27,1	28,5	**30,9**	13,9	19,6
(6) Potential acidification (Z)	billion mol H^+	≤1000	29,5	32	29	30	31	29	**15,8**	21
(7) Other pollution (G)	Fl. million	$\leq 10^6$	885	1041	741	820	835	680	875	**278**
Average annual % growth of:										
- gross output				3,1	4,8	4,7	5,1	4,7	−2,4	2,5
- value added				3,3	4,6	4,5	4,4	3,7	−1,6	1,7
- exports				3,2	5,6	5,7	6,2	5,9	−5,0	2,2
- consumption (domestically produced)				3,9	3,5	3,6	2,9	1,9	−0,2	2,1
- employment				0,9	2,0	2,0	2,0	1,1	−3,6	0,3
- labour productivity[c]				2,2	2,7	2,6	3,1	3,5	1,3	2,2
Average level of:										
- investment (1985=100)				117	168	163	175	172	60	116
- investment ratio[d] (%)				16,8	22,6	22,0	23,8	24,3	11,1	18,5
- unemployment '91-'95 (1000 man-years)				604	200	221	298	725	2185	1163

Source: WRR, GBF Optimalization, E51 round 1.
a) With the exception of objectives 3 and 5.
b) Difference between the index figure for value added and that for employment at the end of the projection period. In both cases 1985=100.
c) Drop in the labour coefficient (= employment in man-years per million guilders of gross output). Macro figure, including Public Administration and Defence and Health Care & Education, where by convention productivity is virtually constant.
d) Gross investment in fixed assets divided by gross value added.

Examining the goal variables, we obtain the following picture. The volume of *consumption,* including imports of consumer goods, can grow by no more than 4.3% a year. This percentage is higher than that for the domestically produced part alone, since it has been assumed that the secular growth of the import ratio will also continue in the future for a number of consumer goods. The model moreover opts for higher consumption growth rates in sectors where the import ratio is comparatively high. The maximization of consumption produces a structure of production with a low growth in labour productivity. Despite this the level of unemployment remains high and also fails to display a downward tendency at the end of the projection period.

As seen in the previous section, the growth in *employment* is a maximum of 2% a year. This growth is achieved together with a comparatively rapid rise in labour productivity. Vigorous export growth and a high level of investment are important conditions. Even so it takes until 1993 before employment is reduced to the frictional level of 100,000 man-years.

The largest deviation in a given year with respect to a previously specified *growth path for unemployment* may be reduced to 176,000 man-years. The trend in unemployment is then:

Table 3.2 Trend in unemployment (1000's of man-years)

Goal value	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Optimization restult	760	836	761	669	575	476	376	276	176	176	100
Target value	-	700	600	500	400	300	200	100	0	0	0
Deviation from target	-	136	161	169	175	176	176	176	176	176	100

Under this optimization, therefore, it takes longer for unemployment to be reduced to the frictional level. This would appear to be the price that has to be paid for a sharper decline in unemployment in the early years. In comparison with the employment scenario, there is somewhat greater emphasis on consumer expenditure. In consequence there is a somewhat lower growth in productivity.

The highest attainable growth in *exports* is 6.2% a year. This requires a very substantial programme of investment. In this respect (and also in others) the maximization of exports resembles the maximization of employment. In optimizing exports, however, a more productive structure of production is selected: the macro-economic rate of growth of labour productivity is 0.4% point higher than in the employment optimization. The large investment programme does, however, call for a fairly large input of labour.

If the aim is solely to increase *labour productivity,* the latter can be increased by a maximum of 3.5% a year. In that case, however, the structure of production gets badly skewed, with the Non-Profit Services sector and the Consumer Services sector suffering in favour of Manufacturing and Construction. In the tertiary sector, the only sectors that manage to hold their own are Transport and Communications, Business Services and Trade (the latter sector being complementary to the sale of goods).

Potential *acidification* is capable of being reduced to an average level nearly 50% below that in 1985. Under this optimization, an average of 0.9 billion guilders is invested annually in controlling emissions of acidifying substances. Emission abatement is not, however, the only instrument used to combat unabated emissions. The macro-economic growth figures in Table 3.1 indicate that the exclusive pursuit of the objective of diminishing potential acidification means that a number of production and consumption activities go by the board. This is also evident from the annual figures for emissions and abatement:

Table 3.3 Trend in emission and abatement of acidifying substances (billions of mol H^+)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Pre-abatement emission	29,5	29	29	29	29	29	28	27	27	26	25
Abatement	-	0	6	12	14	14	14	14	15	15	15
Post-abatement emission	29,5	29	23	17	15	15	14	13	12	11	10

Not only do treatment activities rapidly reach a high level, but pre-treatment emission declines, meaning that certain activities go by the board and economic growth becomes negative. The question as to whether a substantial reduction in the emission of acidifying substances is also possible in a growing economy is discussed in the next section.

As might have been expected, the minimization of *'other pollution'* does not lead to negative macro growth figures. This is because these emissions have been selected

in such a way that they are capable of full-scale abatement by the pollution-control sector. The inability of this sector to be switched instantly to full capacity explains why the average level of unabated emission cannot be reduced to zero. Resultant shifts occur in the structure of production which may be designated as selective shrinkage, such as a fall in the consumption of industrial goods. Given maximum effort and an economic growth path as produced by this optimization, untreated pollution is reduced to zero after six years, as shown in the following table:

Table 3.4 Trend in emission and abatement of other pollution (millions of guilders)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Pre-abatement emission	885	869	855	841	827	812	798	792	823	841	866
Abatement	-	0	148	296	444	592	740	792	823	841	866
Post-abatement emission	885	869	707	545	383	220	58	0	0	0	0

3.4 The trade-off between goal variables

In the previous section we have seen the separate optimum values that can be achieved. Combining these with the least favourable values from Table 3.1, we obtain an impression of the margins within which the permitted solutions lie. Those margins are still very large, and may be reduced by subjecting the various goal variables to tighter restrictions. If this is done, it is reasonable to expect that less favourable optimum values will then be obtainable for each of the objectives. In other words, the objectives will begin to conflict with one another at a certain point. The point at and extent to which this occurs is discussed below.

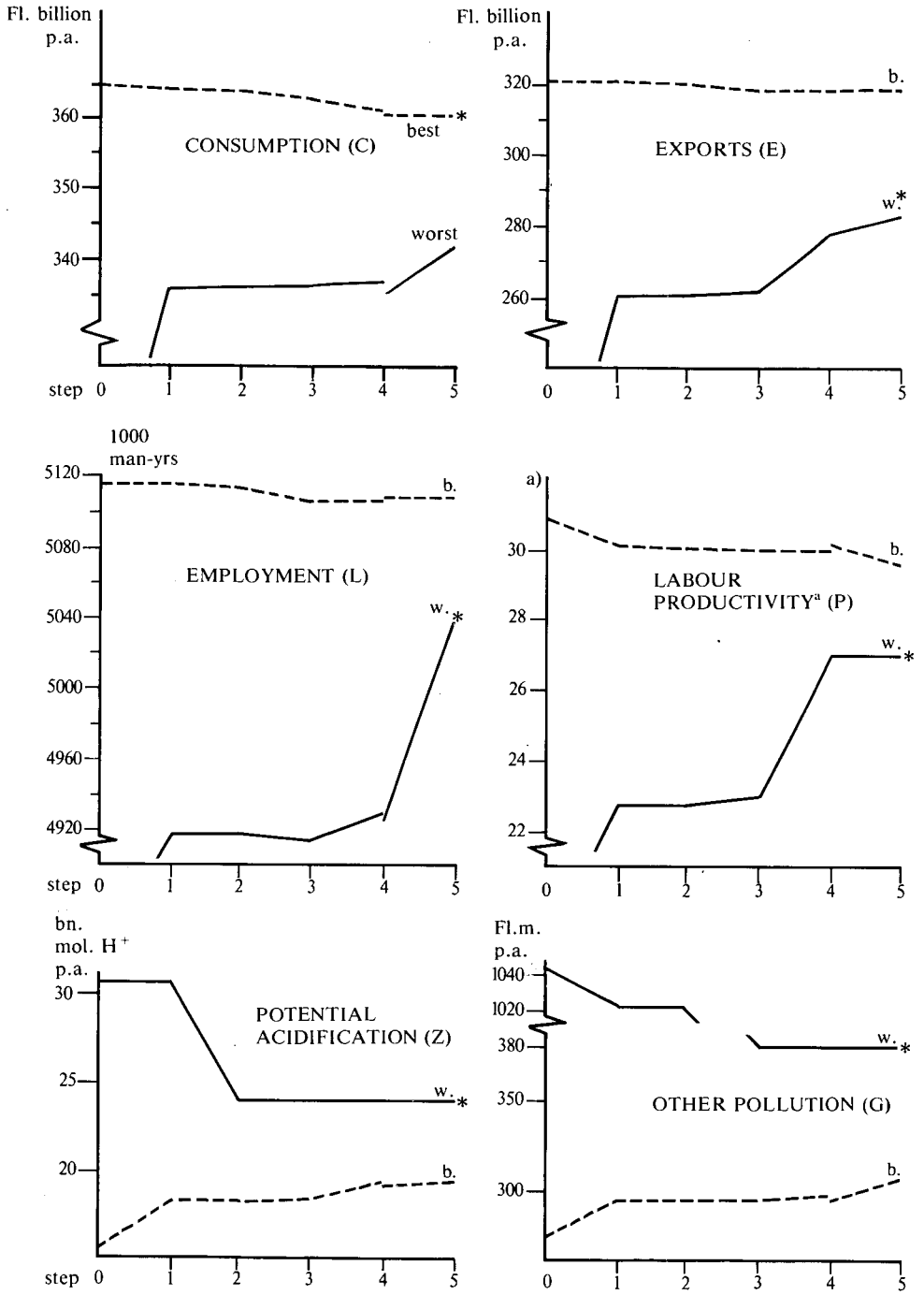
The procedure is a stepwise one. The starting point (round zero) is the optimization of the individual goal variables without subjecting the remaining goal variables to constraints. This has been done in the preceding section (see Table 3.1). In succeeding rounds the minimum requirements are successively tightened for the largest unemployment, potential acidification, other pollution, labour productivity and finally the average level of employment. The minimum requirements for the successive rounds are shown in Table 3.5.

Table 3.5 Stepwise tightening of the minimum requirements for the goal variables

		Round						Unit
		0	1	2	3	4	5	
Consumption	≥	0	.	.	.	.	.	Fl. billion
Employment	≥	0	.	.	.	.	5040	1000 man-years
Unemployment[a)]	≤	3000	400	400	400	400	400	1000 man-years
Exports	≥	0	.	.	.	.	.	Fl. billion
Productivity[b)]	≥	0	.	.	.	27	27	
Potential acidification	≤	1000	.	24	24	24	24	bn. mol. H^+
Other pollution	≤	10^6	.	.	380	380	380	Fl. million

a) Largest deviation in relation to the annual target.
b) Difference in index figure for value added and for employment at the end of the projection period (1985 = 100 in both cases).

Figure 3.1 Changes in best and worst values of the goal variables as goal constraints are tightened (averages over the projection period, with the exception of productivity)



* value of the goalvariable in the balanced growth scenario

Source: WRR, GBF optimizations, E51, EIJ, rounds 1-5, EIK rounds 1 and 2.

a) Difference in index figures for value added and for employment at the end of the projection period (1985 = 100 in both cases).

In this stepwise procedure, the central consideration consists of improving what is regarded as the worst value.

1. On the basis of the results of the zero round, as shown in Table 3.1, the first step consists of eliminating scenarios in which unemployment exceeds 400,000 man-years in the medium to long term (i.e. from 1993). Negative growth

scenarios are thus ruled out. The consequences of this requirement for the optimal values for the remaining goal variables may be read off in Figure 3.1 (step 1) as the changes in the 'best values' (i.e. the broken line). The most important changes relate to productivity and the two pollution categories.

2. The worst values for potential acidification and other pollution (which both occur when consumption is maximized) mean a sharp increase in unabated emissions in relation to 1985. As a second step, the unabated emission of potentially acidifying substances is limited to the standards considered attainable by the Ministry of Housing, Physical Planning and Environmental Control in 1990 and 2000. This means an average emission of 24 billion mol. H- per year over the projection period. All other objectives are more or less affected as a result. In particular, the best values for exports and, to a lesser extent, consumption and employment suffer as a result (see Figure 3.1, step 2). The reduction of potential acidification and reducing the category of other untreated pollution do not, however, conflict with one another to any significant extent.
3. The latter objective is the subject of step 3. This is subject to the constraint that a number of environmental measures from the 1987-1991 Environmental Control Indicative Multi-Year Programme are carried out (see Table 2.2). This amounts to the gradual reduction of the relevant pollution to zero in 1993 and beyond. The average value per year of the unabated pollution would then be in the region of Fl. 400 million. The optimal values for exports and consumption would fall as a result. Similarly the maximum attainable value for the level of employment falls. Despite the fact that the investment needed to combat other pollution (Fl. 650 million a year) is smaller than that for achieving the required acidification standard (namely Fl. 940 – 1370 million a year, depending on the goal being optimized), this restriction demands greater sacrifices for these three goal variables than the previously formulated objective for potential acidification. An analysis of shadow prices indicates that abatement measures are sufficient for complying with the acidification standard, whereas meeting the norm for other pollution also requires adjustments in the structure of production and consumption. Such adjustments are expensive, especially, the analysis shows, in terms of the maximum possible level of consumption. It may be asked whether this requirement has perhaps been made too exacting, and calculations bear out the fact that a certain relaxation of this restriction is linked with a sharp decline in shadow prices.
4. The results for step 3 indicate that highly divergent developments are possible for macro-economic labour productivity. The maximization of consumption, in particular, leads to a structure of production with low labour productivity. This is not so desirable, both with a view to long-term Dutch competitiveness and with a view to the optimal utilization of factors of production. Step 4 accordingly imposes the requirement on labour productivity of a minimum growth of 2.5% a year (the maximum growth under step 3 being 3.2% a year). As might be expected, consumption then has to settle at a lower level.
   This step takes us into a permitted area where in all scenarios value added grows at over 4% a year. The initial assumption of constant public investment now becomes difficult to sustain, for which reason the same round has been recalculated with a growth in government investment that follows the growth in national income (albeit lagged). In Figure 3.1 two points (which sometimes coincide) have accordingly been shown for step 4, namely the results with and without a rise in public investment. The major differences occur in relation to the highest possible level of consumption (i.e. Fl. 500 million a year less) and the highest attainable level of employment (an additional 5,000 man-years a year). These differences may be interpreted as the direct expenditure effect of the additional public investment of Fl. 1.5 billion. The model does not permit the indirect influence on the level of activity, corporate investment or productivity to be shown. This point is explored in a more qualitative sense in Chapter 4.
5. Despite the fact that the rate of growth in all the remaining scenarios is quite high, the assumed supply of labour means that the trend in unemployment is not always satisfactory. The requirement for unemployment to fall to 400,000 in 1993 and succeeding years provides no guarantee that developments will be sought whereby unemployment falls below this level. If optimizations are conducted on the basis of the goal restrictions in steps 1 to 4, a number of these are indeed

coupled with resistant levels of unemployment. This is not, of course, the case if employment itself is maximized. This optimization indicates the extent to which a thinner 'tail' and hence more attractive scenarios are possible. By boosting the minimum requirement for average employment per year in step 5 a set of scenarios is obtained in which unemployment declines more rapidly. High rises in labour productivity are, however, ruled out as a result, although the decline in the maximum attainable growth rate (from 3.2% to 3.0%) is by no means dramatic.

Goal restrictions have now been set in the interactive process for five of the seven goals, the exceptions being exports and consumption. Since all the scenarios in step 5 provide for a reasonably substantial growth in the exports of goods and services, there is no real reason for imposing a lower limit on exports. Moreover, taken over the period as a whole, the balance of payments is not in deficit. On account of the balanced growth scenario discussed in the following section, no lower limit has been set for consumption as a goal variable. In this scenario, the optimization of consumption is selected from the seven possible optimizations in step 5, so that a lower limit would be superfluous. In making calculations for variants of this balanced growth scenario at a later stage (see section 3.6 and Chapter 4), it may be necessary

Table 3.6 Goal variable values under tighter goal constraints (average for the projection period[a]), constant prices)

Goal variables	Unit	Restriction	1985 value	(1) Max! C	(2) Max! L	(3) Min! W	(4) Max! E	(5) Max! P	(6) Min! Z	(7) Min! G
(1) Consumption (C)	Fl. billion	≥0	285	**361**	352	353	342	346	346	342
(2) Employment (L)	1000 man-y.	≥5040	4561	5040 (,012)	**5113**	5094	5040 (,012)	5040 (,010)	5040 (,007)	5040 (,256)
(3) Largest deviation from target unemploym. path (W)	1000 man-y.	≤400		330	212	**182**	312	340	313	331
(4) Exports (E)	Fl. billion	≥0	229	287	306	301	**319**	312	283	296
(5) Productivity (P)[b]		≥27	0	27 (1,27)	27,6	27,1	28,3	**29,6**	27 (,411)	27 (5,54)
(6) Potential acidification (Z)	bn. mol H^+	≤24	29,5	24 (,124)	24 (1,60)	24 (2,27)	24 (,248)	24 (,036)	**19,5**	24 (,280)
(7) Other pollution (G)	Fl. million	≤380	885	380 (,054)	380 (,071)	380 (,083)	380 (,035)	380 (,001)	380 (,0005)	**308**
In brackets: shadow prices = change in goal value upon change in goal restriction by one unit.										
Average annual % growth of:										
- gross output				4,6	4,8	4,7	5,1	5,1	4,5	4,7
- value added				4,3	4,6	4,5	4,5	4,5	4,3	4,4
- exports				5,1	5,7	5,6	6,1	5,9	4,5	5,4
- consumption (domestically produced)				3,8	3,4	3,5	2,9	2,8	2,9	3,1
- employment				2,0	2,0	2,0	2,0	2,0	2,0	2,0
- labour productivity[c]				2,6	2,7	2,6	3,0	3,1	2,5	2,7
Average level of:										
- investment (1985 = 100)				156	171	166	177	183	171	175
- investment ratio[d] (%)				21,3	23,1	22,5	24,0	24,7	23,4	23,9
- unemployment '91–'95 (1000 man-years)				292	200	225	269	300	283	271

Source: WRR, GBF, Optimalization, E51 round 1.
a) With the exception of objectives 3 and 5.
b) Difference between the index figure for value added and that for employment at the end of the projection period. In both cases 1985 = 100.
c) Drop in the labour coefficient (= employment in man-years per million guilders of gross output). Macro figure, including Public Administration and Defence and Health Care & Education, where by convention productivity is virtually constant.
d) Gross investment in fixed assets divided by gross value added.

to formulate a minimum requirement for this goal variable. For the present, however, the interactive optimization procedure is not taken beyond the five steps outlined above. The possible developments in which the model restrictions are satisfied and the target restrictions progressively tightened in steps 1-5 are called the 'balanced growth area'. This area is to a certain extent delimited by the seven optimizations, as shown in Table 3.6. The term 'balanced' refers to the fact that acceptable values have been achieved for all the goal variables, whether or not by setting explicit requirements.

The effect of tightening the five goal constraints in combination may be seen by comparing the diagonal elements (in bold) in Tables 3.1 and 3.6. The volume of consumption has had to fall by an average Fl. 3 billion a year, and the volume of exports by some Fl. 1.7 billion. In terms of the maximum attainable demand for labour, the price for reducing the unabated emission of polluting substances is a total of 9,500 man-years per annum [3]. In the early years the environmental investments compete with other forms of expenditure of greater relevance for employment in the long term. Even so it is possible for unemployment to reach the frictional level of 100,000 in 1995 (as a result of which the average rate of growth of employment is the same for all optimizations). Within the framework of this model and the data input in question, the requirement of reducing pollution and aspirations in respect of employment therefore come into conflict in the short term only. The minimum unabated emission of potentially acidifying substances suffers more from the tightening of the goal constraints than the minimum that can be attained for the 'other pollution' category. Finally the imposition of the employment restriction results in up to 0.4% point less growth in labour productivity.

The extent to which the various goal variables come into conflict is once again shown in Table 3.7. The indications presented do not have a universal validity; they apply only to the particular set of figures fed into the model and for the step-by-step tightening of the goal constraints described above.

Table 3.7 Conflicts between goal variables

	Consumption	Employment	Exports	Productivity	Potential acidification	Other pollution
Consumption	-					
Employment	c	-				
Exports	.	c	-			
Productivity	cc	cc	o	-		
Potential acidification	c	c	cc	cc	-	
Other pollution	cc	c	cc	c	o	-

Source: WRR.
o = No or hardly any conflict.
c = Conflict slightly.
cc = Conflict sharply.
. = Not tested.

So far future economic developments have been discussed in terms of the 'maximum attainable' only. Attainability itself has not been discussed, although all sorts of constraints have been imposed and relationships established in the model that provide an implicit or explicit judgement about plausibility. In order to form a view about the attainability of the scenarios outlined here it is not sufficient to look just at the results presented so far; the conditions attached to the realization of the goals need also to be examined. The growth figures presented at the bottom of Table 3.6 already provide an impression of the average path of a number of macroeconomic variables. In order to form a more precise judgement – to be substantiated in a more qualitative sense in Chapter 4 – the results need to be studied in more detail. The following section presents the essential details for one of the scenarios, namely the maximization of the volume of consumption under the restrictions for the other goal variables specified in Table 3.6. In selecting the maximization of consumption we are falling back on Adam Smith's classical adage that consumption is the sole and final purpose of all economic activity [4]. The desire for more employ-

ment is, after all, largely a reflection of the desire for more income to be used for the purposes of consumption. Paid work does, of course, cover more than just earning a livelihood, as reflected in the high lower limit set in the balanced growth scenario for the level of employment.

3.5 A balanced growth scenario

This scenario indicates how, subject to the constraints adopted in the model, consumption can be maximized if it is also stipulated that:
- unemployment should fall substantially in the medium term;
- the productivity of labour per hour should rise by at least 2.5% a year;
- the balance of trade should not be subject to sustained deficits or large surpluses;
- the unabated emission of potentially acidifying substances (NO_x, SO_2, ammonia) and other pollution is reduced on a scale complying with the environmental quality standards laid down by the Ministry of Housing, Physical Planning and Environmental Control.

The constraints laid down in the model are discussed in part II of the Dutch version of the report; the precise formulation of the additional wishes may be derived from Table 3.6 in the preceding section. A number of macro-economic results are presented in Table 3.8 below, followed by an examination in more detail of (i) the final expenditure categories of consumption and exports, (ii) the required input of labour and capital and, finally, (iii) pollution.

Table 3.8 Key indicators in the balance growth scenario

	Annual rate of growth	Average level 1986–1995 (1985 = 100)
- Gross output	4,6%	127
- Valued added	4,3%	125
- Exports	5,1%	125
- Imports	5,7%	135
- Consumption of domestic production	3,8%	124
- Total consumption	4,2%	127
- Investment in housing	0,0%	100
- Total investment	7,4%	156
- Employment	2,0%	111*
- Private sector productivity[a)]	2,8%	117
- Total labour productivity[a)]	2,6%	115*

	Levels 1985	1986–1995	1995	
Balance of trade	+ 18,0	+ 2,3*	+ 12,0*	Fl. billion
Unemployment	760	502	100*	1000 man-years
Investment ratio[b)]	17%	21%	22%	
Emission of acid substances	29,5	24,0*	23,2	billion mol H^+
Emission of other pollution	885	380*	0	Fl. million

Source: WRR, GBF, Optimalization E1K R201.
* Binding constraint in this scenario.
a) Gross output per man-hour.
b) Gross investment in fixed assets as a percentage of gross value added.

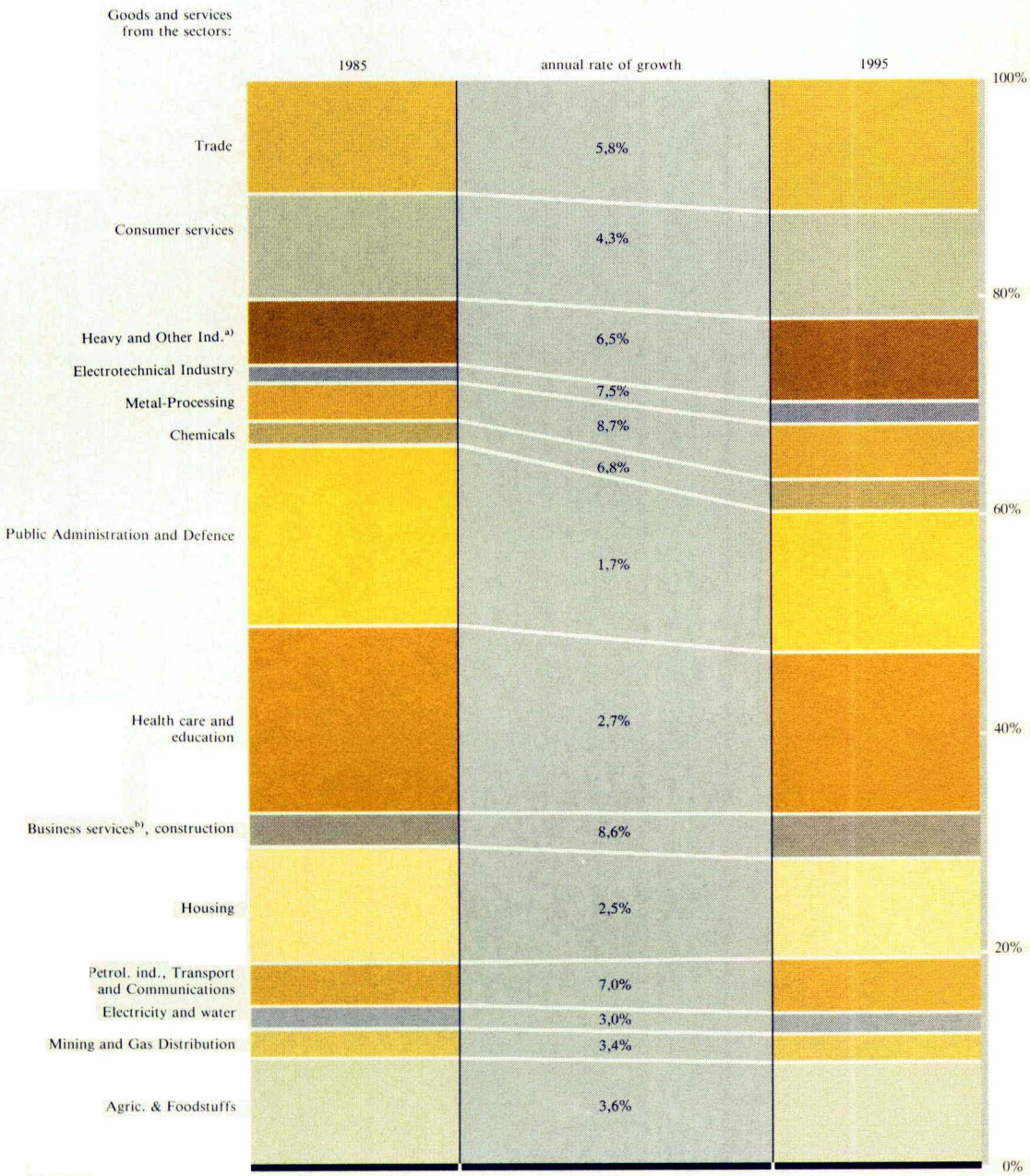
3.5.1 *Consumption*

The total volume of consumption, including imported consumer goods, grows on average by over 4% a year. The pattern of consumption is to a significant extent determined by the sectoral upper limits imposed in the model. Thus the upper limit for consumer good sales are binding in all years in every industrial sector, with the

exception of Chemicals. In the case of services this applies only to Transport & Communications and Business Services.

Figure 3.2 provides an impression of the breakdown of consumption in 1995 in comparison with that in 1985. The bottom categories may be regarded as the more essential forms of expenditure, such as that on foodstuffs, heating and lighting, transport, housing, insurance and banking services, public health and education, and government. The share of these forms of expenditure (in constant 1983 prices) is declining, especially on account of the comparative lag in expenditure on non-profit services. With respect to those services relating to the more essential

Figure 3.2 Composition of consumption, 1985 and 1995 (in percent) and annual rate of growth, 1985–1995 (in percent)



Source: WRR, GBF optimization, EIK R201.

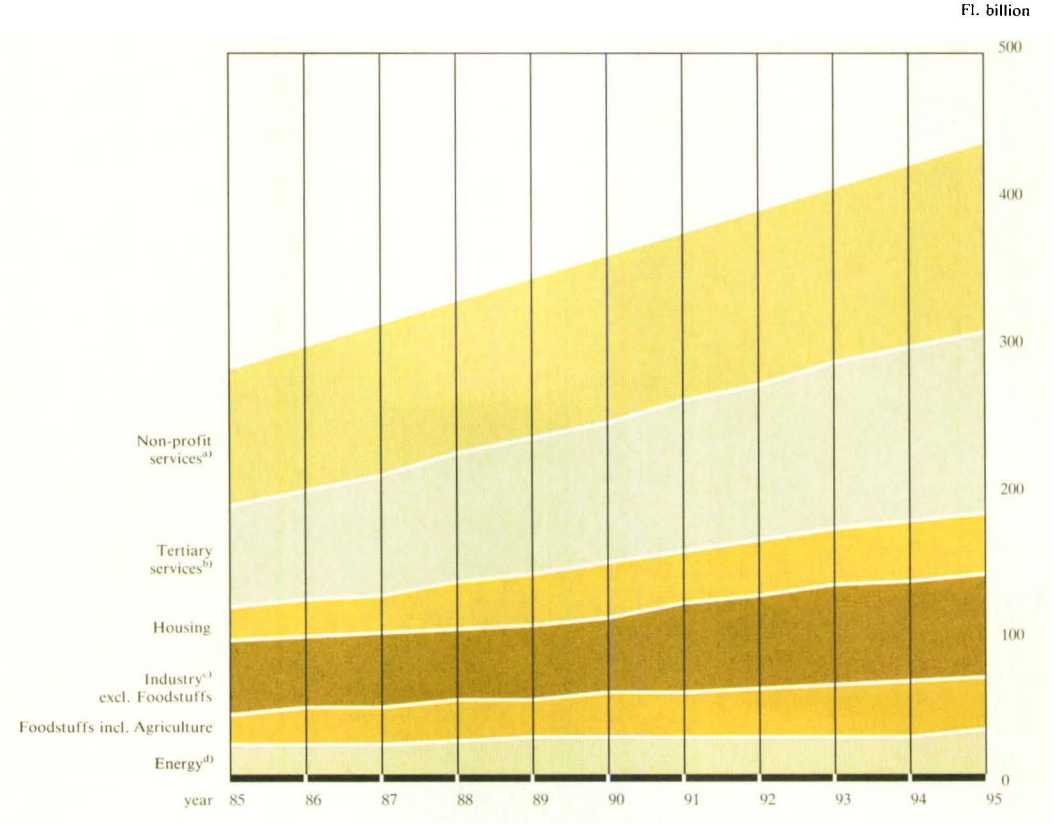
a) Heavy industry comprises basic metals, building materials, ceramics and glass. Other industry comprises textiles and clothing, leather goods, timber and furniture industry, the printing industry and publishing.
b) Including banking and insurance.

categories of consumption, relative prices may be expected to rise since the growth in labour productivity in these services is below the average for the economy as a whole and it is not reasonable to assume that wages will continue to move in line with this lower growth rate year after year. The composition of consumption in current prices in 1995 is certain to have a different complexion.

Within the category of essential consumption, or what might also be generically labelled 'compulsory consumption', the growth in business services stands out. In the case of household consumption the growth is concentrated on insurance, banking services (excluding interest margins), legal services and temporary employment agency services. A growth rate of 8% a year is high but not inconceivable. Another area of growth is health care. Assuming no increase in the consumption of educational services, these results imply a 5% growth for health services. This is consistent with the high growth for Chemicals, including medicinal drugs, but is at variance with various policy intentions.

Apart from Chemicals, high rates of consumption growth are also recorded for Electrical Engineering, the Metal-Processing Industry and Other Industry (clothing and footwear, furniture and printing and publishing). The share of imports of these consumption categories increases, so that total consumer sales grow somewhat more rapidly than the domestically produced. This does not, however, produce major problems for the balance of trade, since sufficient is exported.

Figure 3.3 Trends in the composition and level of consumption, 1985–1995 (in billions of guilders, 1983 prices)



Source: WRR, GBF optimization, E7K, R201.

a) Health care and education, Public Administration and Defence.
b) Trade, Consumer services, Transport and Communications, Business Services.
c) Chemicals, Heavy Industry, Metal-Processing and Electrotechnical Industry, Other Industry, Construction.
d) Mining and Gas Distribution, Petroleum Industry, Electricity and Water.

3.5.2 *Exports*

The growth in exports of goods and services in this scenario comes to over 5% a year, i.e. somewhere between the figures in the high-growth, long-term scenario of

the Central Planning Bureau (6%, 1985-2000) and the medium-term survey by the same organization (5%, 1986-1990) [5]. In macro-economic terms, therefore, there are no great differences, but between product groups certain contrasts emerge. As far as exports of goods are concerned, this scenario requires a stronger expansion of the Petroleum Industry and Heavy Industry (i.e. basic metals and construction materials) than envisaged in the Central Planning Bureau's medium-term projection (see Table 3.9). The remaining industrial goods exhibit the same trends in our scenario as they do in the Central Planning Bureau projections. Exports of agricultural products and foodstuffs, by contrast, are clearly lower in the balanced growth scenario.

The above scenario calls for considerable efforts to increase the exports of services. This applies especially to Transport and Communications, where there are both threats and opportunities, and to a lesser extent to Business Services (i.e. banking and insurance, exports by research institutes and other business services).

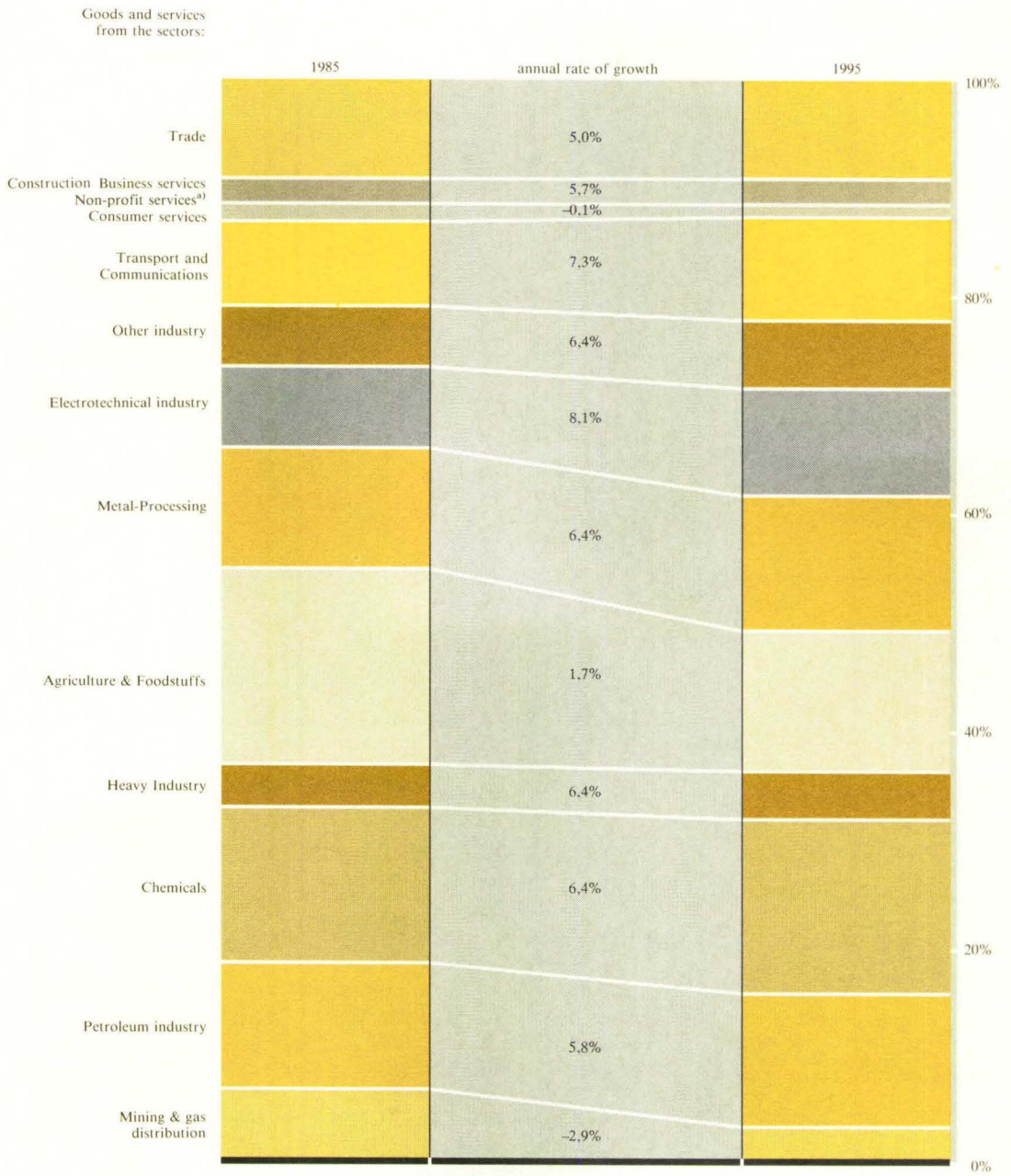
Figure 3.4 shows the shifts in the composition of exports. The lowest product groups represent the basic commodities such as natural gas, petroleum, chemicals (although this also includes fine chemicals), steel and construction materials. This group manages to maintain its share because the predicted fall in natural gas exports is compensated for by above-average growth in the other sectors. A growing West German economy would appear a prerequisite for realizing this scenario. The share of foodstuffs, including agricultural products, declines by over 5% points in the ten-year period. Against this there is a substantial increase in the share of the industrial sectors which produce processed or final goods. These are also the sectors that achieve the maximum permitted rate of growth from 1988 onwards.

Tabel 3.9 Export growth 1963-1973, 1973-1983, 1983-1986 and 1986-1995 (constant prices, annual percentage)

		'63-'73	'73-'83	'83-'86	WRR '86-'95	CPB base-projection '86-'90
1,7.	Agriculture & foodstuffs	8	5	4½	1½	3
2.	Mining and gas dist.	16½	1	−6	−3	−2½
8.	Petroleum industry	13½	−2½	1½	6	3½
3.	Chemicals	18½	3½	5½	6½	6½
4.	Heavy Industry	11	2	4	6½	4
5.	Metal-proc. industry	11	3	5½	6½	6½
6.	Electrotechnical industry	11½	3½	9½	8	8
9.	Other Industry	9	½	8	6½	5
14.	Transport & Communications	5½	2	3½	7½	4½
13,16-18.	Other services	-	4½	2½	3½	3
12.	Trade	9	3	7	5	5½
	Private Sector total	10½	2½	4	5	5

Source: WRR, GBF, optimization E1K R201 (colom 4).
Central Planning Bureau, *Central Economic Plan 1986*, The Hague, 1986, Annex D2.

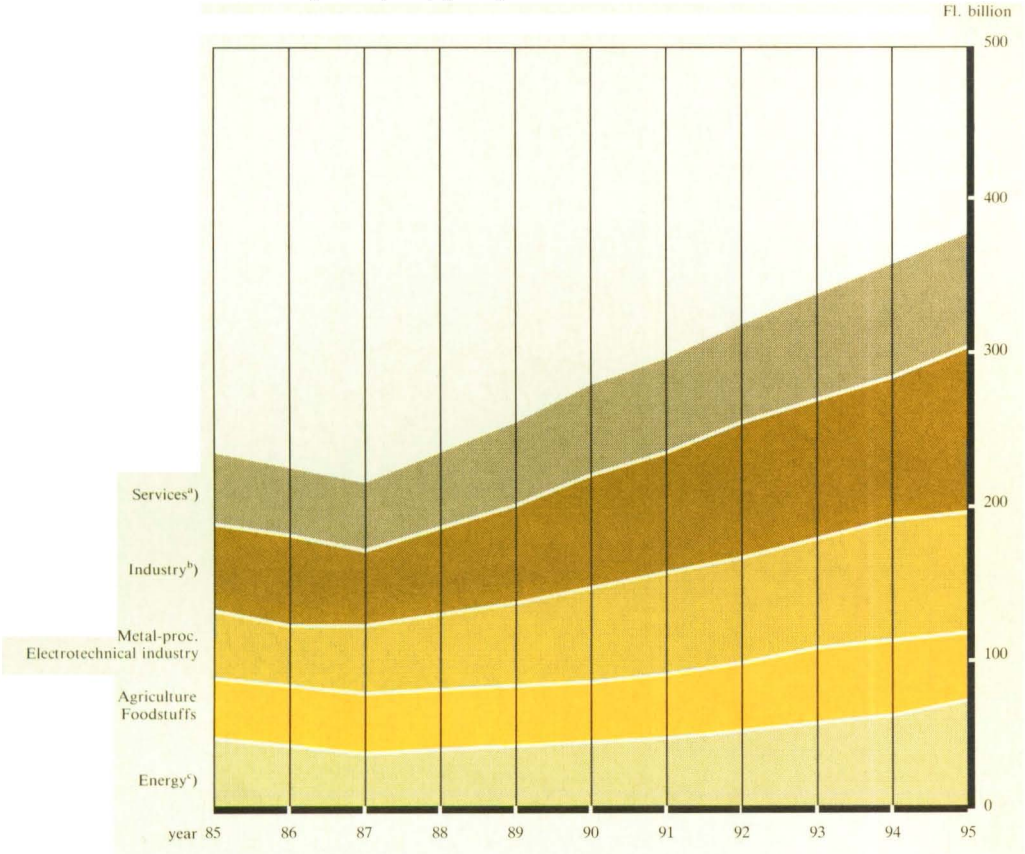
Figure 3.4 Composition of exports, 1985 and 1995 (in percent) and annual rate of growth, 1985–1995 (in percent)



Source: WRR, GBF optimization, EIK R201.

a) Non-profit services cover Health care & Education and Public Administration and Defence.

Figure 3.5 Trends in the composition and level of exports, 1985–1995 (in billions of guilders, 1983 prices)



Source: WRR, GBF Optimization, EIK R201.

a) Trade, Consumer services, Transport and Communications, Housing, Business Services, Health Care & Education, Public Administration and Defence.
b) Chemicals, Heavy Industry, Other Industry, Construction.
c) Mining and Gas Distribution, Petroleum Industry, Electricity and Water.

3.5.3 *The demand for labour* [6]

In order to achieve the level of economic growth shown in the scenario, roughly a fifth more labour is required in 1995 than the level of employment in 1985. This means an average annual increase of 2%. The demand for labour first equals the expected supply of labour less frictional unemployment in 1995. In both a quantitative and a macro-economic sense, the supply of labour does not therefore act as an obstacle to economic growth until 1995. Not least because of changes in the structure of the demand for labour (see Figure 3.6), shortages are nevertheless likely to occur in a qualitative sense (i.e. matching the required skills with the available qualifications) and in specialized markets.

The picture in manufacturing industry is mixed. In the Foodstuffs industry there is a decline in employment, but in the Heavy Industry, Metal-Processing Industry, Chemicals and Other Industry the demand for labour rises. In the case of the Electrotechnical Industry and the Petroleum Industry the demand for labour is virtually unchanged. In net terms the number of jobs in industry grows over the ten years by over 80,000 to nearly one million in 1995. Demand rises especially in the Metal-Processing sector (with a growth of 4,400 man-years per year) and in the printing, clothing, textiles and furniture industry (a growth of 4,000 man-years a year).

More labour is required in all the services sectors. The demand for labour rises especially in those sectors with low rises in labour productivity, i.e. consumer and medical services. It is precisely in these areas that the problem of the comparative rise in prices for these services arises (see Ch. 4), so that it is a matter of relying

Table 3.10 Growth in employment in man-hours (annual percentage)

	WRR Maximize consumption 1986/1995	CPB HIGH scenario 1985/2000
Agriculture	−3¾	0
Manufacturing industrie[a)]	1	¾
Energy[b)]	−1	¾
Construction	5	0
Services	2½	2¼
Private Sector total	2	1½

Source: WRR, GBF, Optimization, EIK R201.
Central Planning Bureau (CPB), *De Nederlandse Economie op langere termijn* (The Dutch Economy in the Longer Term), Working Document, The Hague, 1985, p. 66. This assumes an annual 0.5% reduction in working hours. The growth rates presented for the volume of labour in man-years have therefore been reduced by 0.5% in order to indicate the rise in man-hours.

a) Excluding the Petroleum Industrie.

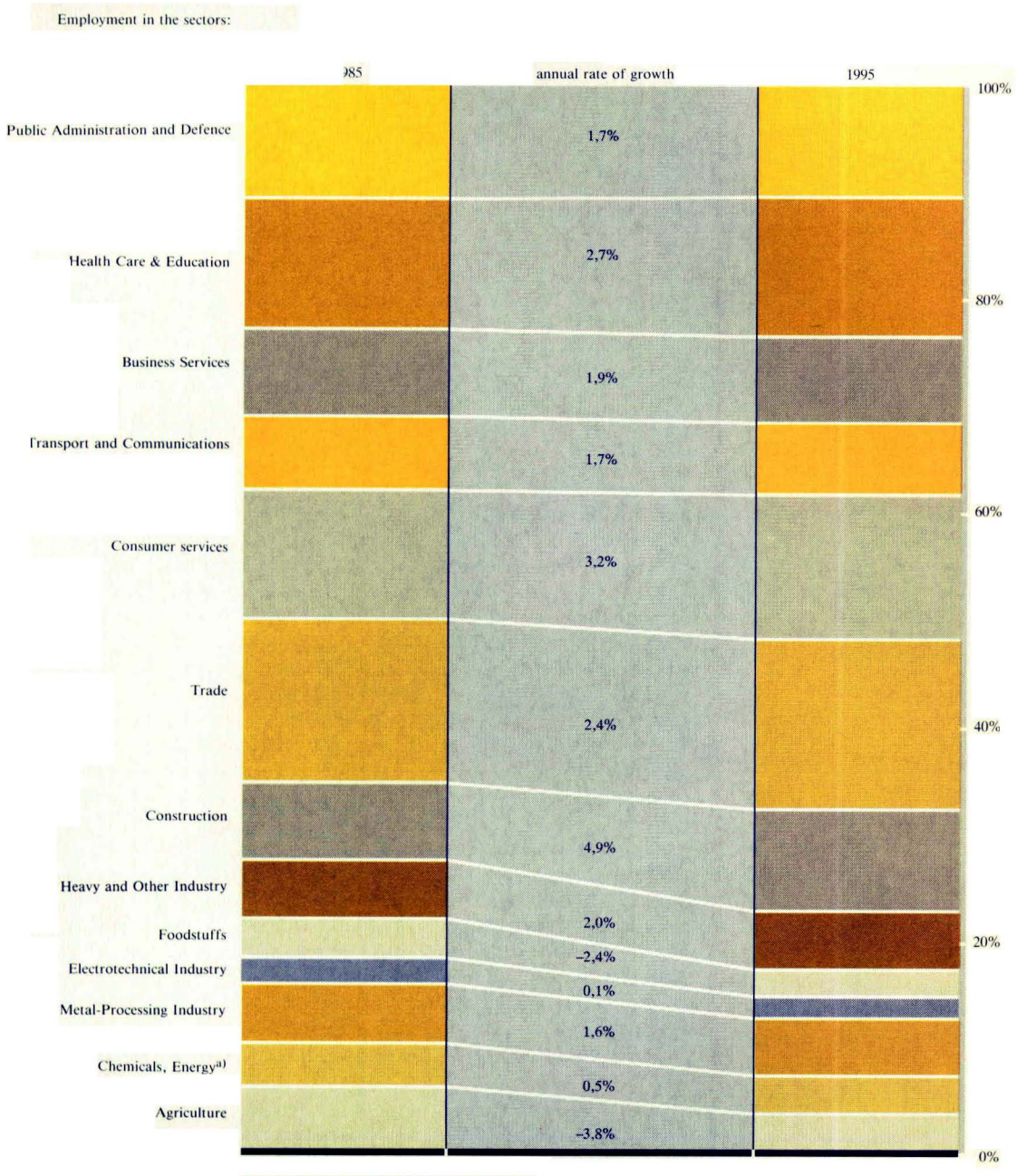
b) Mining and Gas Distribution, Electricity and Water, Petroleum Industry.

either on consumers' willingness to pay these higher prices or on effective policies to moderate them. Employment in Business Services, Transport and Trade rises roughly on a par with employment in the economy as a whole.

The number of government employees rises by 1.7% a year. This amounts to an annual increase of 9,000 full-time jobs for civil servants in the field of public administration in the broad sense and defence, given a level of employment in this area in 1985 of half a million. If the proposed cuts in the central government service are achieved in the next four years, this will mean that some 15,000 extra jobs will have to be added annually in other areas of the government service (making up two-thirds of the total Public Administration and Defence sector in terms of staff numbers). Current policy intentions are directed towards an overall reduction in the number of government employees. For the non-profit sector as a whole, including social care, the calculations have therefore been conducted with an upper limit of zero growth up to 1990 for the Public Administration and Defence and Health Care & Education sectors and part of Consumer Services (see variant C, section 3.6).

The rise in the demand for labour in Construction is comparatively high, with an additional 17,000 jobs a year being required. This is closely linked to the substantial increase in the level of investment. A significant difference arises in this respect with the high-growth, long-term Central Planning Bureau scenario. Table 3.10 provides a comparison between these Central Planning Bureau simulations and the results obtained from our optimizations. This reveals another notable difference, namely the much lower demand for labour calculated for Agriculture in our scenario as the result of lower production growth and a higher rise in productivity.

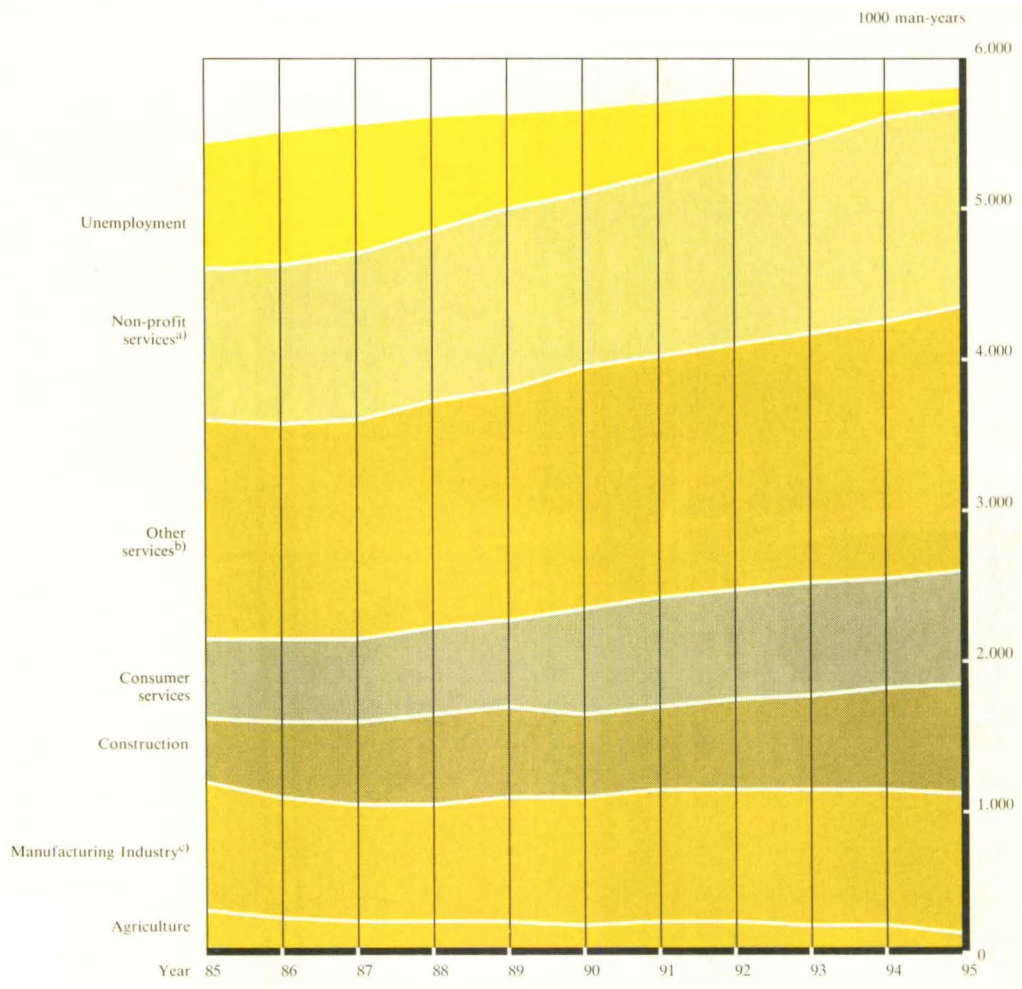
Figure 3.6 Composition of employment, 1985 and 1995 (in percent) and annual rate of growth 1985–1995 (in percent)



Source: WRR, GBF Optimization, E1K R201.

a) Energy comprises Mining and Gas Distribution, the Petroleum Industry, Electricity and Water.

Figure 3.7 Trends in the composition and level of employment, 1985–1995 (in 1000 man-years)



Source: WRR, GBF Optimization, EIK R201.

a) Health Care & Education, Public Administration and Defence.
b) Trade, Transport and Communications, Housing, Business Services.
c) Mining and Gas Distribution, Chemicals, Heavy Industry, Metal-Processing and Electrotechnical Industry, Foodstuffs Industry, Petroleum Industry, Other Industry, Electricity and Water.

3.5.4 *Investment*

Like employment, a certain level of investment is an essential precondition for bringing about the economic developments described above. A major difference, however, is the fact that capital goods can be produced by the production system, whereas labour has it were to be supplied from outside. The supply of labour can accordingly form an absolute and permanently limiting factor to growth (although at national level labour migration affords something of a solution), while in theory a capital deficit is no more than a temporary growth inhibitor. However, in the time-frame to which our optimizations apply – i.e. the medium to long term – the investment requirements can seriously interfere with the realization of other objectives (especially consumption). Precisely what are those requirements?

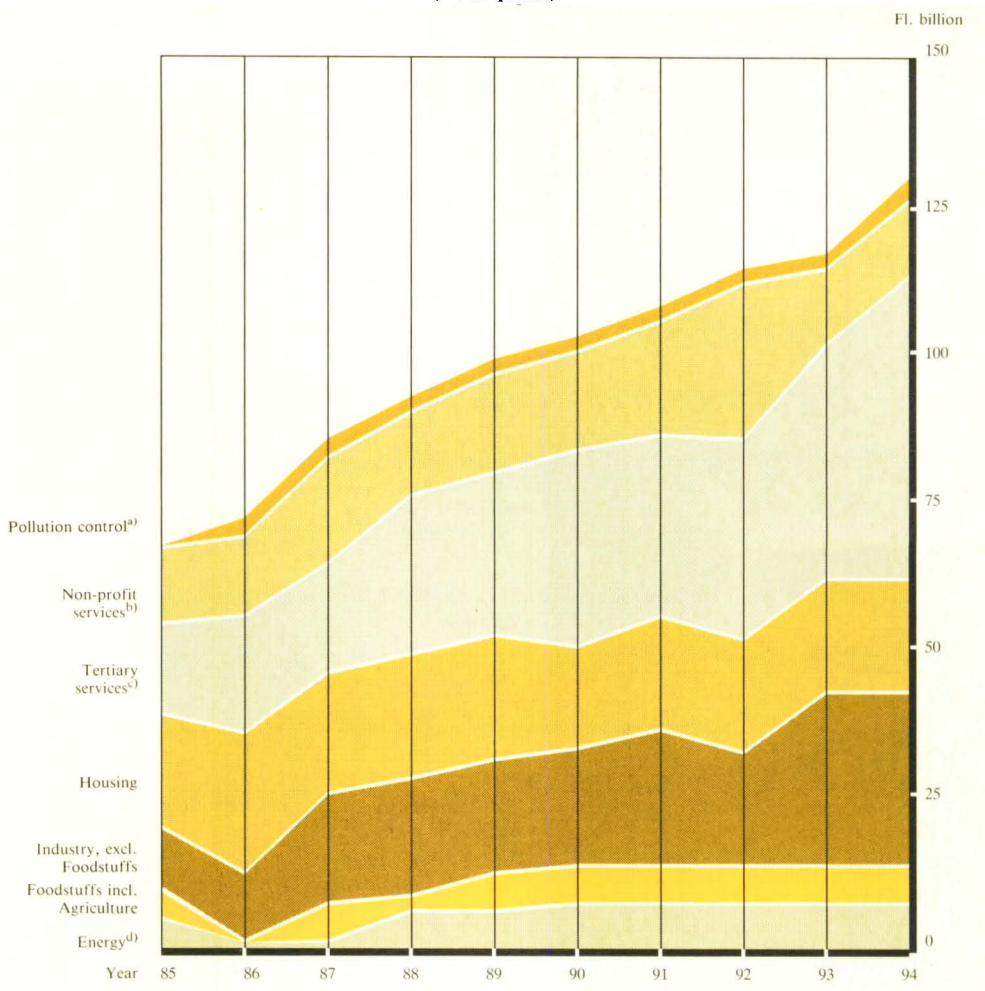
In macro-economic terms the investment ratio needs to reach a level 4% points higher than that in 1985, i.e. a rise of 17% in 1985 to an average of over 21% in the years 1986-1995. Figure 3.8 indicates that this rise needs to take place throughout the period and virtually across the board, with particular emphasis on Chemicals (for exports), the Metal-Processing and Other Industry and Transport and Communications (for exports and employment), Trade and Consumer and Business Services (for employment).

Table 3.11 Investment ratios in 1985 and 1986-1995 (in percent)[a)]

		1985	1986 – 1995
1.	Agriculture	18	13
2,8,10.	Energy	14	17
3.	Chemicals	27	57
4.	Heavy Industry	23	28
5,6.	Metal-Proc. and Electrotechnical Industry	12	15
7,9.	Other processing industry	14	25
3 – 9.	Industry	17	27
11.	Construction	6	12
12.	Trade	9	12
14.	Transport and Communications	26	32
13,16,17.	Consumer and Business Services, Health Care and Education	7	12
12 – 14, 16,17.	Services[b)]	10	16
15.	Housing	68	59
18.	Public Administration and Defence	25	28
1 – 23	Total	17	21 [c)]

Source: WRR, GBF, Optimization, EIK R201.
a) Gross investment in fixed assets as a percentage of gross value added.
b) Excl. Housing, incl. Health Care & Education.
c) Incl. pollution control.

Figure 3.8 Composition and level of investment, 1985–1994 (in billions of guilders by sector of investment, 1983 prices)



Source: WRR, GBF Optimization, EIK R201.

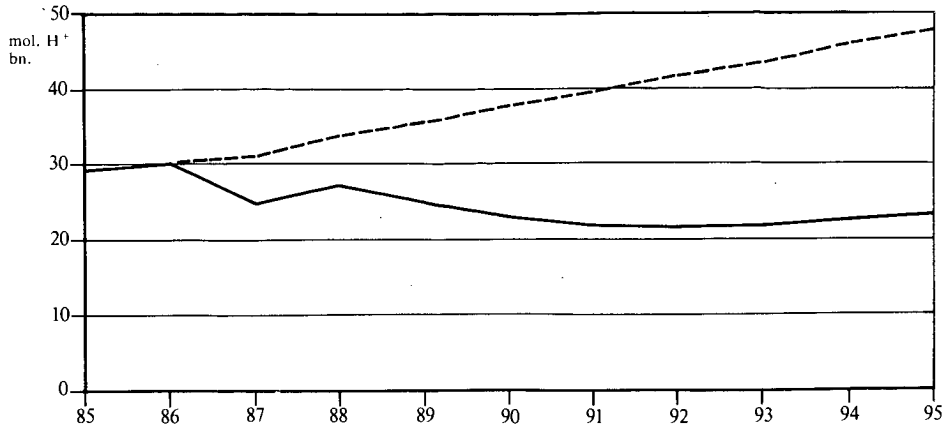
a) Abatement of acid substances and other environmental measures.
b) Health Care & Education, Public Administration and Defence.
c) Trade, Consumer services, Transport and Communications, Business Services.
d) Mining and Gas Distribution, Petroleum Industry, Electricity and Water.

3.5.5 *Pollution*

As noted earlier, the requirement has been laid down that by 1995, the emission of potentially acidifying substances (i.e. NOx, SO2 and ammonia) should comply with the environmental quality standards laid down by the Ministry of Housing, Physical Planning and Environmental Control. As may be seen from Figure 3.9, this is achieved primarily by (additional) pollution control activities. The required investment amounts to Fl.1.3 billion a year, or over 1.25% of the total gross investment in fixed assets and over 0.25% of gross national product.

It was seen in section 2.5 that two kinds of limits have been incorporated in the model for pollution abatement capacity: a technical maximum, expressed as a percentage of the emission to be abated, and a financial ceiling, expressed as the maximum amount to be invested per category of pollution control techniques. In the case of the most expensive techniques, the latter ceiling (Fl.535 m.) is binding in eight of the ten years. In the case of the cheapest pollution control sectors (i.e. with low production costs per mol. H^+ controlled) the technical limit is also binding in a number of cases. For the cheapest pollution control techniques, this applies from 1990 onwards, for medium-cost techniques from 1992.

Figure 3.9 Emission of potentially acidifying substances before and after abatement, 1985–1995 (in mol. H^+ bn.)

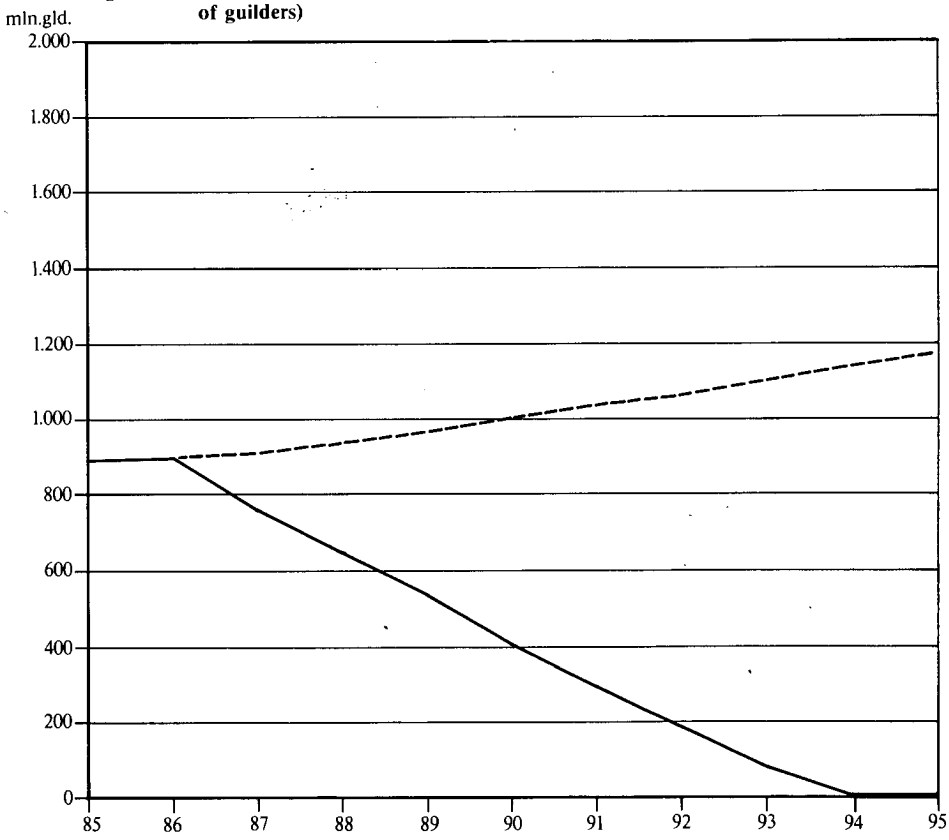


——— after abatement

– – – – before abatement

Source: WRR, GBF Optimization, EIK R201.

Figure 3.10 Emission of other pollution before and after abatement, 1985–1995 (in millions of guilders)



——— after abatement

– – – – before abatement

Source: WRR, GBF Optimization, EIK R201.

At the same time the requirement has been laid down that in due course, a number of measures should be taken to combat environmental pollution and nuisance (see Table 2.2). These measures are specified in the Environmental Control Indicative Multi-Year Programme, the aim being to reduce such 'other pollution' to zero by the end of the projection period. As may be seen from Figure

3.10, this is achieved by the maximum utilization (with the exception of one year) of the pollution abatement sector relating to these types of pollution and environmental nuisance. On average this requires an annual investment of Fl.630 million, so that the total environmental investments in this scenario amount to almost Fl.2 billion per annum, or nearly 2% of total public and private investment in fixed assets.

3.6 Provisional conclusions and various variants

The economic structure of the Netherlands as described in this model does not in principle prohibit the attainment of a growth rate approaching 5%. This corresponds with the natural rate of growth increased by over 1.5% additional growth for the absorption of current unemployment. The setting of requirements with respect to the balance of trade, maximum permitted level of pollution, level of unemployment and labour productivity interferes only marginally with that objective: growth rates of over 4% remain possible within the constraints imposed under the model.

If pursued to extreme, each of the above objectives comes into conflict with the others. If, however, extremes are not pursued, the realization of individual goals is often fully compatible with, or even a condition for, the realization of other objectives. The growth of labour productivity and exports is for example coupled in this way; the two are highly interdependent. To a somewhat lesser extent consumption and employment exhibit a similar link. As soon as full employment is stipulated as a medium-term requirement, consumption has to grow by at least 3% a year.

In addition there are of course other objectives that are less readily reconciled. Thus for example the maximization of consumption conflicts with a high growth in labour productivity since higher consumption entails the expansion of generally lowproductive services. Similarly the aim of maximum labour productivity and maximum employment growth cut across one another to some extent. Nevertheless the conflict is less pronounced than might perhaps be expected at first glance on the basis of the statistical truth that in macro-economic terms, the growth in employment is equal to economic growth minus the rise in labour productivity. The cyclical nature of the economy and the changes that can take place in the composition of national product mean that such wisdom with hindsight in a prospective analysis is not particularly meaningful. The fact is that these three macro variables are interconnected in all sorts of ways and that the final result can be determined only by means of a dynamic multi-sector analysis. It then emerges that, within the constraints imposed by the model, a rise in labour productivity of over 3% a year does not exclude a rise in the demand for labour (measured in man-hours) of 2% a year.

This phenomenon of objectives that are inherently at variance with one another but not to the point of ruling out acceptable levels, is also reflected in the results with respect to the environment. The environmental quality standards for the future emission levels of potentially acidifying substances demand a not inconsiderable level of investment, but are also compatible with a highly acceptable rate of growth for consumption and employment. The same applies to the remaining environmental measures.

Provisionally, it may be concluded that neither the technical structure of the economy nor the desire simultaneously to pursue various objectives rule out progress towards the various targets for the goal variables. A number of significant conditions do, however, need to be satisfied. A recurrent prerequisite is the need for a substantial increase in the investment ratio, especially in the private sector (excluding housing). Sales prospects abroad and the competitiveness of Dutch industry must also be sufficient to permit an annual rise in exports of between 5 and 6%. An economy expanding along these lines requires an annual 2% increase in labour input. Given the projected growth in the supply of labour, while assuming a small reduction in working hours and a limited increase in part-time employment, the labour market will run into shortages around the mid-1990s. The additional input of labour is concentrated in the fields of tertiary services and construction (the latter in connection with the higher level of investment). The industrial demand for labour in manufacturing rises only slightly, while that in agriculture declines. With the exception of the Health sector, where it is fairly high, the growth in employment in the Non-Profit sector is only moderate.

The constraints outlined above indicate that achieving a balanced growth scenario

along these lines will not be easy, let alone self-evident. Although the Council remains convinced of the need and usefulness of a long-term vision of higher production and employment, the question also arises of the consequences of a failure to fulfil those conditions. These consequences may in part be systematically explored in the model - in part because a number of the obstacles to moving the economy into a higher gear do not lend themselves to incorporation in a model. Those that can be examined are:

A. the consequences of stagnating exports. The causes might include stagnating world trade, e.g. because of increasing protectionism, or a weakening in Dutch competitiveness;
B. the consequences of a failure, for whatever reason, for investment to rise substantially;
C. a variant in which the consumption of non-profit services is deliberately cut back sharply. Motives to this end may include:
   - a reduction in the government deficit;
   - a reduction in the tax and social insurance burden;
   - independent objectives (e.g. a preference for allocation by market forces, for self-employment or simply for different goods and services).

   It is interesting to see to what extent other objectives, especially employment, are then squeezed.
D. the consequences for the rise in prosperity of a lower supply of labour. At first glance these consequences appear trivial: if the supply of labour becomes binding, the economy is unable to grow faster than the rise in that supply plus that of labour productivity. This is not, however, the case since the productivity of labour is capable of being varied by adjustments in the composition of production and the rate of production growth.

Table 3.12 Maximization of consumption under different assumptions

Goal variables[a)]	Balanced growth scenario	A Lower exports	B Lower invest-ment	C Fewer non-profit services	D Lower labour supply
(1) Consumption (Fl. billion)	361	352	349	352	360
(2) Employment (1000 man-years)	5040*	4744*	4624	4963*	4909
(4) Export (Fl. billion)	287	259	242	288	281
(5) Productivity	27*	22,6*	22,6*	27*	27*
(6) Pot. acid'n (mol. H^+ bn.)	24*	24*	24*	24*	24*
(7) Other pollution (Fl.m.)	380*	380*	380*	380*	380*
Average annual % growth of:					
- gross output	4,6	2,8	2,1	4,6	3,8
- value added	4,3	2,8	2,2	4,3	3,6
- exports	5,1	2,3	1,3	5,2	4,7
- consumption (domestically produced)	3,8	3,5	3,1	3,4	3,5
- employment	2,0	0,6	−0,1	1,9	1,1
- labour productivity	2,6	2,2	2,2	2,6	2,7
Average level of:					
- investment (1985 = 100)	156	122	110	160	141
- investment ratio (%)	21,3	17,8	16,4	22,1	19,8
- unemployment '91-'95 (1000 man-years)	292	797	994	381	143
- net trade balance (Fl. billion)	2,3*	2,3*	2,3*	2,3*	2,3*

* Binding

Source: WRR, GBF Optimization, E1K R201, E1N R201, E1P R201, E1M R201, E1O R201.

a) Average for the projection period, with the exception of objective 5.

The macro-economic results of these variants may be compared in Tables 3.12 and 3.13. They provide the quantitative framework for analysing the model results in a more qualitative sense in Chapter 4. For the present the results may be presented without further comment.

Tabel 3.13 Maximization of employment under different assumptions

Goal variables[a)]	Balanced growth area[b)]	A Lower exports	B Lower invest-ment	C Fewer non-profit services	D Lower labour supply
(1) Consumption (Fl. billion)	352	340	339	345	353
(2) Employment (1000 man-years)	5113	4797	4693	5036	4967
(4) Export volume (Fl.m)	306	260	262	306	296
(5) Productivity	27,6	22,6*	22,6*	28,1	27*
(6) Pot. acid'n (mol. H^+bn.)	24*	23,9	23,8	24*	24*
(7) Other pollution (Fl.m.)	380*	380*	380*	380*	380*
Average annual % growth of:					
- gross output	4,8	3,3	2,9	4,9	4,0
- value added	4,6	3,2	2,7	4,4	3,6
- exports	5,7	2,3	2,6	5,7	4,9
- consumption (domestically produced)	3,4	2,9	2,9	3,1	3,2
- employment	2,0	1,1	0,5	2,0	1,1
- labour productivity	2,7	2,2	2,3	2,8	2,9
Average level of:					
- investment (1985 = 100)	171	143	124	177	151
- investment ratio (%)	23,1	20,8	18,3	24,1	20,9
- unemployment '91-'95 (1000 man-years)	200	685	870	282	100
- net trade balance (Fl. billion)	8,1	4,2	9,0	5,6	7,6

* Binding

Source: WRR, GBF Optimization, E1K R103, E1N R203, E1P R203, E1M R103, E1O R203.
a) Average for the projection period, with the exception of objective 5.
b) Upon optimizing employment.

1 The terms 'employment' and 'demand for labour' are used interchangeably in this chapter. Strictly speaking the model calculates the demand for labour expressed in man-hours, or in man-years given unchanged working hours. For the present it is assumed that the demand for labour results in actual employment. The fact that this is not assured - e.g. because demand and supply may not be matched in a qualitative sense – is discussed in Chapter 4.
2 J. Burle de Figueiredo and H. Rato, *Bachue-Brazil – National Version a Demo-Economic Model;* International Labour Office, Working Paper no. 47, Geneva, February 1977.
3 To preserve comparability, the consequences of the recalculation with growing public investment in step 4 need to be discounted.
4 Adam Smith, *Wealth of Nations;* Random House edition, fourth book, ch. 8, p. 625.
5 Central Planning Bureau, *De Nederlandse economie op langere termijn* (The Dutch Economy in the Longer Term), Working Document, The Hague, 1985, p. 43.
Central Planning Bureau, *Centraal Economisch Plan 1986* (Central Economic Plan 1986), The Hague, Staatsuitgeverij, 1986, annex D2.
6 See note 1.

4. GROWTH-IMPEDING FACTORS

4.1 Introduction

In the previous chapter the possibilities were explored of simultaneously realizing a number of socio-economic and environmental objectives. This revealed that the techno-economic structure of the Netherlands as described in the model did not rule out the ability to achieve growth figures approaching the natural rate of growth. It also emerged that the simultaneous realization of a number of socio-economic and environmental objectives does not necessarily lead to serious obstacles to growth; growth indeed often turns out to be a condition for achieving those goals. While this may be an interesting perspective, which the Council has felt useful to outline in some detail, it does not of course present a complete picture of economic developments in the Netherlands over the next ten years. The existence and persistence of growth-inhibiting factors have to be accepted.

Although it is in principle possible to arrive at a complete summary of the conditions that need to be fulfilled in order to achieve a resumption in economic growth, the number of potential growth-inhibiting factors is by contrast virtually unlimited. This chapter examines the threats to a resumption of economic growth. In doing so the approach has necessarily been selective. The selection made is not free from an implicit judgement about the seriousness of the potential obstacles. The conditions for the realization of the balanced growth scenario to be deduced from the previous chapter act in the first place as a guideline from the selection of the potential obstacles to growth to be discussed in this chapter. In that sense these conditions form the link between Chapters 3 and 4. In addition the Council would like to explore a number of potentially inhibiting factors which have to be left out of the model for a number of reasons. These include the problem of the public sector deficit, in which respect supplementary calculations have been carried out in collaboration with the Central Planning Bureau. Similarly, with respect to the environment more factors come into play than just those included in the model. Despite these additions, the discussion below remains selective and hence to a certain extent subjective in nature.

The potential growth-impeding factors are grouped into seven subject areas. In discussing these subjects in the full Dutch report suggestions are made for the way in which government policy might be slanted to counter these dangers. A brief examination of these areas must suffice in this English summary.

4.2 Environment

Is it possible that environmental problems would be accentuated by a resumption in economic growth to such an extent as to interfere with that growth? This question is relevant because the economic slump in the early 1970s is in part attributable to the view widely held at that time that economic growth and environmental protection were not mutually compatible. Large-scale industry and agriculture became the butt of widespread criticism in the Netherlands.

The achievement of selected environmental goals has therefore been included in the analysis as one of the aspects of a rise in welfare. The abatement of potentially acidifying substances and the implementation of a number of officially proposed environmental measures in other fields result in a certain trade-off between the environmental and the socio-economic objectives. However, it appears to be possible to achieve values deemed acceptable for all the objectives. The achievement of environmental goals would entail an additional annual investment of Fl.1.9 billion. In macro-economic terms this would appear feasible, amounting as it does to only 0.4% of GNP. The financial burden would, however, be spread very unevenly among enterprises and products. In due course the costs of environmental control will be expressed either in the price of certain goods and services or in a collective levy. In the former case this would create a risk of a drop in consumer

demand for the product in question or displacement by cheaper foreign products – with, in turn, a potential adverse effect on the domestic propensity to invest. Collective levies on the other hand harbour the danger that the tax and social insurance burden will be regarded as too heavy, giving rise to all sorts of disruptive reactions in the form of tax avoidance or evasion or the passing on of the extra charges.

These obstacles can to a significant extent be countered by allowing for potentially adverse side-effects in the way in which these measures are funded. With respect to technically feasible and economically affordable abatement techniques, the point is to devise methods of defraying the costs that provide incentives to apply and improve the available techniques.

From an environmental viewpoint, preference deserves to be given to a method of financing that reflects the 'polluter-pays' principle. This is the case when a *regulatory levy* is imposed on the polluting product or activity, the size of the levy being related to the degree of pollution caused. An example of a regulatory levy in the Netherlands is that imposed under the Pollution of Surface Waters Act, which caused a large number of polluters to institute abatement measures on their own accord. The disadvantages of this system are the need for legislation and administrative provisions and the associated administrative burden.

Another method of financing in which these disadvantages are much less pronounced but which still respects the 'polluter-pays' principle is that of a system of *deposits.* The application of this method is, however, confined to identifiable, widely-marketed products with well-regulated channels of distribution, such as packaging materials, batteries, photochemicals and engine oil. A major advantage of a deposit system is its regulatory effect, in that it can achieve the virtual disappearance of uncontrolled waste, without the need for extensive surveillance.

Another way of covering the costs is by *specific-purpose levies.* In this case the 'polluter-pays' principle is adhered to only in part since there is no direct relationship with the amount of pollution caused. In practice, however, this type of levy tends to be used on a considerable scale, if with some reluctance. One advantage is that a link is at least retained between the environmental problem at issue and the levy. Where the costs are simply met out of public funds, even that link is lost. In addition instruments are being developed to encourage environmental expenditure to be seen as a sensible rather than an enforced expense.

The balanced growth scenario outlined in Chapter 3 results in a rise in production of 57% over the ten years. Clearly, an expansion of this kind is bound to produce environmental problems in the form of greater waste disposal and diffuse emissions of pollutants, and increasing encroachment on the countryside. Even in the case of a moderate-growth sector such as agriculture, the problems will only be partially solved by existing and already proposed measures.

On the one hand it may be concluded on the basis of the above that reducing the emission of potential acidification to an acceptable level and the implementation of a number of proposed measures included in the model need not constitute a macroeconomic obstacle to a rise in prosperity. On the other hand it is evident that major environmental problems will persist, even if a high rate of economic growth is not achieved. For this reason continuing efforts are required to identify environmental problems in good time and to develop an active control policy. Past experience suggests that technical solutions will be found to many of these problems – although at a considerable cost.

4.3 Exports

Both domestic and international developments can impede the required export performance. The variant analysis indicates that this has serious consequences for the attainable growth of income and employment. Government policies can help only to a limited extent: income developments abroad, a growth or decline in protectionism or the problem of international debt are virtually given factors as far as the Dutch government is concerned. Within that framework, however, it is still possible to exploit the available potential to best advantage.

In order to keep the balance of payments on current account in equilibrium, the declining exports of primary commodities (i.e. agricultural products and natural gas) and the below-average growth in exports of foodstuffs need to be compensated

for by an increase in the remaining industrial goods. A further condition consists of a substantial increase in the exports of services, especially in the field of transport and communications. Factors of particular importance in this regard are the development of EC policies in this field and the extent to which Dutch companies are able to hold their own against foreign competition under liberalized conditions.

Apart from quality, delivery times and reliability, research has shown that orientation towards and familiarity with foreign markets have a major bearing on company export performance. In collaboration with industry, the government can help increase companies' export awareness. In addition it is important to maintain access to interesting growth markets, while exports also depend on the continuing promotion of a European home market.

4.4 Labour-intensive services

For employment to grow on the scale required to absorb the anticipated supply of labour, a real growth in the consumption of labour-intensive services is required. The prospective sectoral surveys and model calculations indicate a high rate of growth of sales and employment in these sectors to be both feasible and desirable. In particular, this applies to consumer-oriented personal services provided on both a commercial and a non-profit basis. Examples include the hotel and catering trade, the repair of consumer goods, sport and recreation, care of the elderly and home help, socio-cultural work and health care. These are areas in which the rise in the productivity of labour tends to lag behind that in the economy as a whole, while wage rises will in all probability need to keep broadly in step with the macro-economic growth in productivity. A relative increase in the price of these services may therefore be expected, which could then affect the level of demand for them. If the demand for these services should fail to materialize (at least within the regular economy), an important springboard for economic growth would then be removed.

Encouraging the growth of labour-intensive services by holding back relative price rises is possible to only a limited extent. A general reduction in the difference between gross wage costs and net pay is not in prospect and would in any case be of limited effectiveness only. Given the 4:1 ratio between the price of an hour's services (namely net wage + social insurance contributions + payroll tax + overheads + VAT) and the net modal hourly wage, the size of the reduction required would be such as to rule out general measures. Consideration could, however, be given to shortening the gross-net trajectory in special cases, particularly where market forces are being distorted by the black economy.

A system of wage differentiation between industries with differing productivity growth rates would result in loss of quality and an inadequate supply of labour. Nor would such an arrangement afford a lasting solution to these structural problems, which are related to the nature of technical progress.

At a practical level, government and industry should continue to promote higher labour productivity in order to alleviate the problem of rising costs for labour-intensive services. Although there are technical limits, this strategy has been and is being successfully applied in the field of tertiary services. In order to prevent the consumer services sectors from getting left behind, an alternative way of financing needs to be found that helps coordinate demand and supply.

The government is confronted with the task of resolving problems on the supply side – namely the high tax and social charges burden – without at the same time creating fresh problems on the demand side of the economy by drastically cutting the volume of services. In a prosperous society, a higher price will have to be paid for traditional government functions (e.g. defence, public administration, the administration of justice and education). The same applies to the broad field of social services and health care, although in these cases there is scope for a certain degree of privatization, thereby permitting a less restrictive link with tax rates and social insurance charges.

In a general sense, the tendency for socially beneficial but increasingly expensive services to be more or less automatically transferred to the public sector will have to be countered. Collective forms of payment can be devised that would not result in an increase in the tax and social charges burden. Thus for example matters such as training and child care could be provided as fringe benefits, while more individual facilities could be defrayed through private insurance.

4.5 Labour

In macro-economic and quantitative terms the model calculations for the input of labour in the production process do not produce any sticking points. As a result two potential problems could be lost to sight. In the first place there is uncertainty about the size of the future supply of labour. It is, for example, questionable whether the figure for unemployment in 1985 (namely three quarters of a million) in fact represents deployable labour reserves – although there is probably a certain amount of hidden unemployment as well. Secondly there is the phenomenon of vacancies that employers have difficulty in filling. This study does not examine the question as to whether the skills on demand in the labour market and the qualifications on offer match up. This is the subject of a separate study being carried out by the Council, on which a report is to be issued shortly. The scope for government policy in this field will also be examined in that report.

4.6 The public account

It is important to establish whether the economic growth in the various scenarios is at variance with the government's objectives in relation to the public account and the tax/social insurance charges burden. If that were so, the government's strategy could generate obstacles to growth. The economic growth and changes in the structure of production characteristic of the various scenarios entail both savings and additional receipts (e.g. lower unemployment benefits and a higher tax take) and higher expenditure (on the infrastructure, civil servants' pay, publicly financed services, and so on). What is the net effect?

In order to investigate this, the Central Planning Bureau, on the basis of its long-term model of the public sector and data from various growth scenarios in this report, conducted calculations at the Council's request into the growth in the public sector burden, the budget deficit and a number of other variables. The results indicate that, given unchanged tax rates, the budget deficit will decline sharply in the growth scenarios, while the tax burden will rise a little further, which will in turn be offset by a decline in cost-recovering social insurance contributions.

Given a 4.3% annual growth rate in the balanced growth scenario, the budget deficit falls from 8.8% of Net National Income in 1986 to 6.8% in 1990 and 1.5% in 1995. Under the assumption of zero-growth in non-profit services in the 1980s (the 'lower non-profit services variant', see section 3.6) the budget deficit falls somewhat more rapidly, switching to a small surplus at the end of the projection period. If however economic growth is halved, e.g. for lack of adequate investment (the 'lower investment variant'), the deficit rises to 9.5% in 1995 and the tax burden and especially social insurance contributions rise steadily. An increase in the rate of economic growth is therefore a condition for getting the financing deficit down and preventing a rise in the tax/social charges burden if the demand for non-profit services is to be fulfilled at the same time and employment is to be raised to an adequate level.

In the calculations, the government's expenditure and receipts have been linked to the movement of all the relevant economic variables. On the basis of the model results, the Council would urge a return to structural budget standards. There are, however, certain risks in doing so; under certain conditions, of which the improved decision-making coordination of economic actors is the most important, it should be expected of government that it will be the first to break out of the vicious circle of expenditure restraint.

4.7 The infrastructure

The failure to modernize or maintain the infrastructure can act as an obstacle to new investment in the private sector.

Infrastructural investment also has expenditure effects, but these are only temporary in nature. The impact of an increase in infrastructural spending on the production capacity and productivity is more important. In the production process, infrastructural facilities may be regarded as an additional factor of production to labour and the capital goods accumulated by the corporate sector. They contribute to production, although it is difficult to establish the precise connection between them and production.

Because it is difficult to determine the effects, decisions with respect to investment in infrastructural facilities become subject to various influences, such as the annual budget negotiations or the relative power of the interested parties, that hinder an effective allocation in terms of type of investment and timing. From this viewpoint it is advisable to draw up a detailed and systematic survey of plans in the infrastructural field. Ideally such a survey would consist of three elements:
- a survey of the current state of the infrastructure;
- a survey of the plans and intentions of central and local government, industry and other countries or supranational organizations such as the EC, in so far as these relate to infrastructural facilities;
- gauging the needs on the user side, and the perceived quality of the infrastructure.

There are various reasons why consideration deserves to be given to greater involvement by the private sector in the management and financing of infrastructural facilities. One of these is the need to coordinate the supply and demand for such facilities as effectively as possible. Participation by the private sector can help generate the signals needed for that process to operate more smoothly. This does not of course apply in the case of purely public goods, but there are various facilities the use of which qualifies neither as strictly public nor as strictly private.

Conditions for the privatization of management and financing are clarity as regards the required quality and the accessibility of such facilities, as well as a system of market regulation conducive to more efficient allocation. In this respect privatization and deregulation are at variance with one another.

4.8 Investment

The model results illustrate the need for a substantial increase in investment for a steady rate of economic growth to be achieved. As the 'lower investment variant' indicates, failure to achieve the required level of investment has serious implications for employment. In order to achieve growth figures of over 4% for value added and 2% for employment (in man-hours), the investment ratio in the corporate sector will need to rise to the level that was obtained in the second half of the 1960s and the early 1970s. With the exception of agriculture and housing, increases in the investment ratio are (with varying emphases) required across the board. In addition there is need for greater investment to control environmental problems.

Now insight into the determinants of investment behaviour and into the effectiveness of government policy on this point tends to be inadequate. The scale of investment is to a significant extent determined by the attitude of entrepreneurs to risk-bearing. That attitude appears rather time-bound: periods of distinct risk-avoidance alternate with others in which risks are treated as though they hardly exist. This is reinforced by the fact that such behaviour is also evident among investors.

In view of the fact that an increase in the investment ratio is an essential condition for achieving virtually all the set objectives, special attention needs to be devoted to policies to stimulate investment. Examples include the reduction of uncertainties and shortening the period for which risks are borne. Young, venturesome enterprises and new companies often have difficulty in obtaining equity or loan capital, and it would therefore be desirable to expand the financial infrastructure in order to channel savings to these enterprises. The in some respects difficult position faced by banks deserves special attention in this regard.

4.9 Concluding remarks

The structural relationships of the economic process do not inherently rule out the simultaneous realization of goals with respect to employment, increasing the level of consumption, balance of payments equilibrium, reducing the budget deficit and protecting selected aspects of the environment. In practice, however, these generally endorsed objectives are not realized as fully as theoretically possible. The deficiencies in the market mechanism and the interpenetration of the public and private sectors mean that decentralized decisions lead to sub-optimal results. In the Council's view better results could be obtained if economic actors' decisions were better coordinated. This, however, requires the coordination of policies, for which purpose the institutionalized tripartite consultations between the social partners and the government could be used.

These consultations should be devised in such a way that all parties obtain an insight into the distribution of income that is required for investment to take off and employment to be stimulated. These consultations should not be without commitment but should lead to agreements about each party's contribution to a package of measures to facilitate the realization of those objectives. Confidence could thereby be restored and risk-avoiding behaviour reduced. Risks arising from domestic imbalances can be reduced, while the capacity to withstand exogenous risks would be increased. Growth scenarios as outlined in this report indicate that economic policy does not have to be a zero-sum game. These scenarios are not predictions, but they do afford an insight into the potential benefits to be obtained by each of the parties, as well as providing a frame of reference for selecting the appropriate course to break free from the vicious circle of self-restricting behaviour. In this respect the report provides benchmarks in the form of quantified and specified economic objectives.

ANNEX 1

Sectoral breakdown

1. *Agriculture* (incl. horticulture, forestry and fishery)
2. *Mining and gas distribution* (oil and natural gas extraction and exploration, other mining, natural gas distribution companies)
3. *Chemicals* (basic and final products of the chemical industry, rubber and plastics processing industry)
4. *Heavy industry* (basic metals, construction materials, earthenware, glass and glass products)
5. *Metal-processing industry* (metal products and machinery, transport equipment, instruments and optical goods)
6. *Electrotechnical industry*
7. *Foodstuffs industry* (incl. beverages and tobacco)
8. *Petroleum industry* (oil refineries and manufacture of petroleum and coal products)
9. *Other industry* (textiles, clothing, footwear and leather goods, timber and furniture industry, paper and cardboard, paperware and corrugated cardboard, printing and publishing)
10. *Electricity generation and water supply*
11. *Construction* and installation on construction projects
12. *Trade* (wholesale and retail trade plus intermediaries)
13. *Consumer services* (hotels, restaurants, cafés, repair of consumer goods, social services, culture, sport and recreation, other personal services, private households with salaried staff)
14. *Transport and communications*
15. *Housing*
16. *Business services* (incl. banking and insurance)
17. *Health care and education* (incl. veterinary services)
18. *Public Administration and Defence* (civilian and military)

Added sectors:

19. 'Low cost' acidification abatement sector
20. 'Medium cost' acidification abatement sector
21. 'High cost' acidification abatement sector
22. Hydrocarbons abatement sector (not used in this study)
23. Other environmental measures.

The classification used in this report seeks to achieve the greatest possible homogeneity of input and output, level of sales, import and export quotas, energy production and consumption categories, pollution categories and existing policy considerations (e.g. a separate sector for the government). Apart from the separate sector for government, five sectors have been defined for activities connected to pollution abatement.

The interactive optimization of multiple objectives – diagrammatic representation and example

The linear programming and optimization methods used in this study are described below in geometric terms. First a number of definitions may be provided.

A *goal variable* is the quantification of an objective whereby the value of the variable indicates the extent to which the objective has been realized.

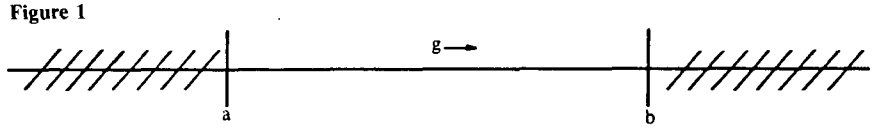
The *goal area* is the area within which the goal variables are permitted to move. If there is only one goal variable, it is part of a line; if there are two variables it is part of a plane; if there are three, part of a body, and so on.

An *optimization* takes place if the best possible value for a goal variable is sought within the goal area.

A *goal constraint* or *goal restriction* is a condition imposed beforehand on a goal variable. The set of restrictions, together with the model, determines the goal area.

Let us assume that there is a single objective, or more specifically that the aim is to optimize variable g subject to two goal constraints, namely g must be greater than a and smaller than b.

Figure 1



The unhatched section a-b is the goal area. The value of g must lie between a and b. If the aim is maximize goal variable g, the solution g = b is optimal; g cannot be further improved. At this point the goal constraint becomes *binding*. If b were to be increased by one unit (by moving it to the right), the optimal solution for the goal variable could then be increased by one unit.

The relationship between this change in the optimal value of the goal variable and in the goal constraint is known as the *shadow price* of the restriction. In this example, 1/1 = 1. The shadow price of restriction a is zero: relaxing the restriction by shifting a to the left does not produce a better optimal value for the goal variable.

An example taking two goal variables is more interesting. Assume goal variable g_1 represents employment and goal variable g_2 consumption in a given year. Assume further that employment is proportional to the volume of production X. The volume of production is equal to outputs i.e. consumption (g_2) and other outputs y (investment + exports + inter-industry sales). This category of other outputs is subject to an upper limit.

These considerations produce the following sub-model (a and b being coefficients with a value greater than zero).

(1) $g_1 = aX$
(2) $X = g_2 + y$
(3) $y \leq b$

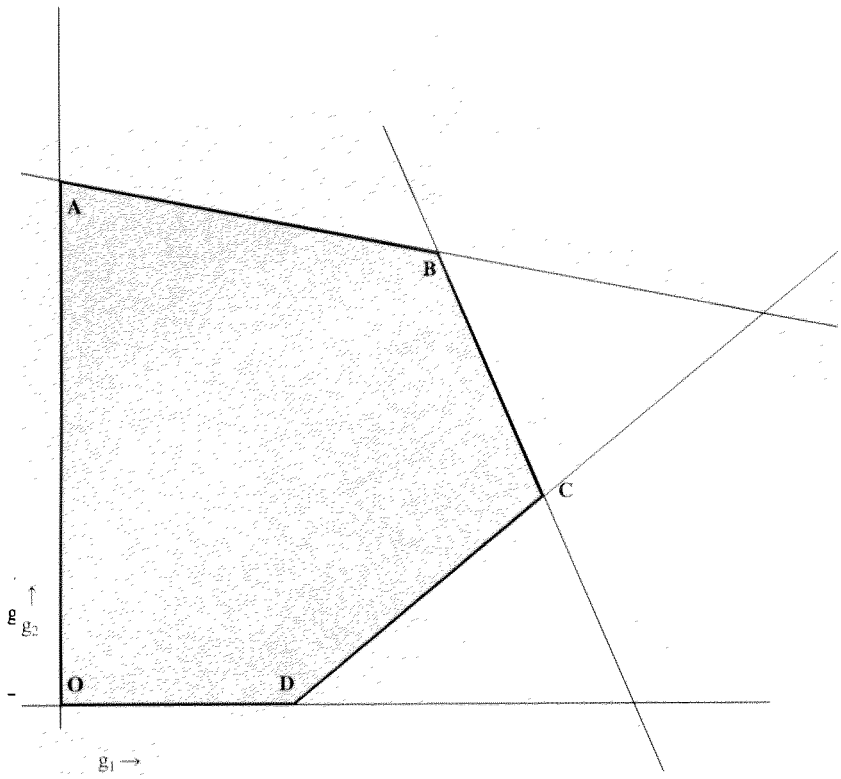
These three equations enable a relationship to be established between the two goal variables in the form of an inequality:

(4) $g_1 - ag_2 \leq ab$

Diagrammatically the inequality (4) may be shown as an oblique line, such as CD

in Figure 2, with to the left the permitted and to the right the unacceptable combinations of g_1 and g_2. These two objectives do not conflict in the sub-model: both employment and consumption can be expanded without limit. By completing the model with more relations and (if necessary restrictive) intermediate variables (the section ABC), the enclosed space ABCDO is obtained. Objectives g_1 and g_2 do now conflict in certain circumstances.

Figure 2



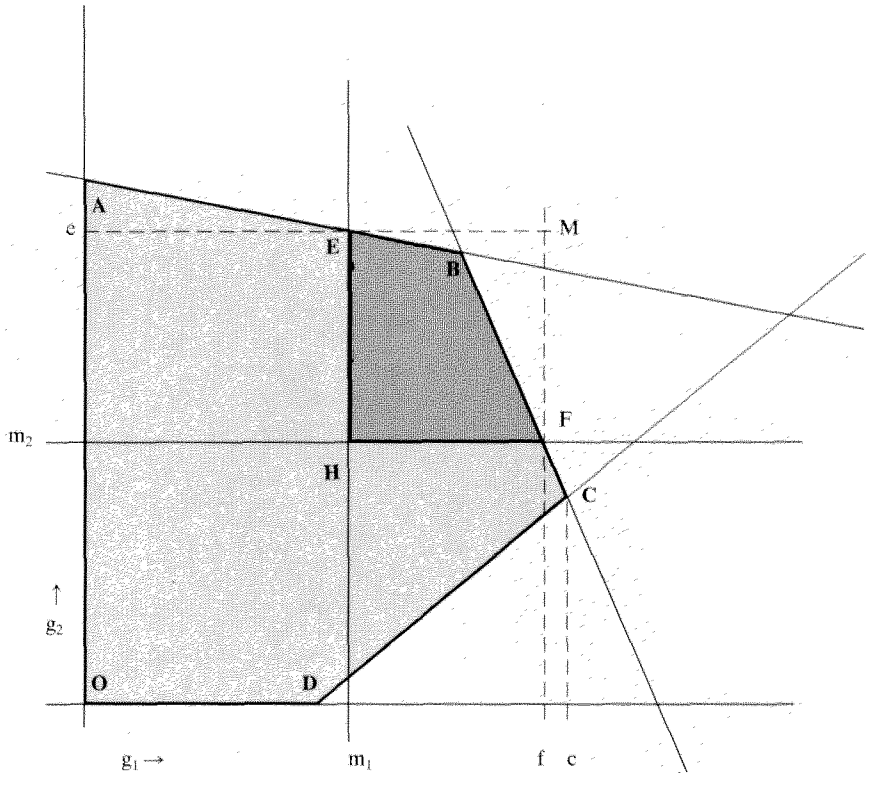
The best possible value for g_1 is point C and the best possible value for g_2 is point A. At point B, g_1 is nearly maximized, while g_2 also approaches it maximum value. The solution chosen depends on the importance attached to g_1 in relation to g_2. Two restrictions are binding on point A, OA and AB. The shadow price for the restriction OA – i.e the benefit to be obtained if this restriction shifts to the left by one unit – is less than 1. More precisely, the shadow price is equal to the tangent (or slope) of the angle made by the lines AB and OD. The greater the angle, the greater the shadow price; the flatter the line, the less the influence.

If there are three goal variables instead of two, the goal area is three-dimensional and becomes more difficult to represent diagrammatically. The difficulties become even more acute with more goal variables which leads to even higher dimensions. Although the number of permitted combinations of values for the goal variables is unlimited, it may be shown that only the vertices (i.e. the points where at least two restrictions intersect) are of importance for optimization purposes.

Interactive optimization of multiple goal variables

The method used in this study is that of Interactive Multiple Goal Programming. This amounts to the successive optimization of each of the goal variables given the minimum values for the other goal variables. These minimum values are known as *goal constraints*. In the two-dimensional example above, suppose that at least m_1 employment and at least m_2 consumption are required. The permitted area within which the optimal values for g_1 (employment) and g_2 (consumption) may be located contracts to the quadrangle EBFH (see Figure 3).

Figure 3



In this situation the maximization of consumption (g_2) produces point E (rather than A as before). This optimal level is lower than when no minimum requirements were laid down for employment. Similarly the maximization of employment (goal variable g_1) leads to point F, entailing a loss with respect to the previous optimum C.

The results of the two optimizations (which taken together are termed a round) are summarized in the following table:

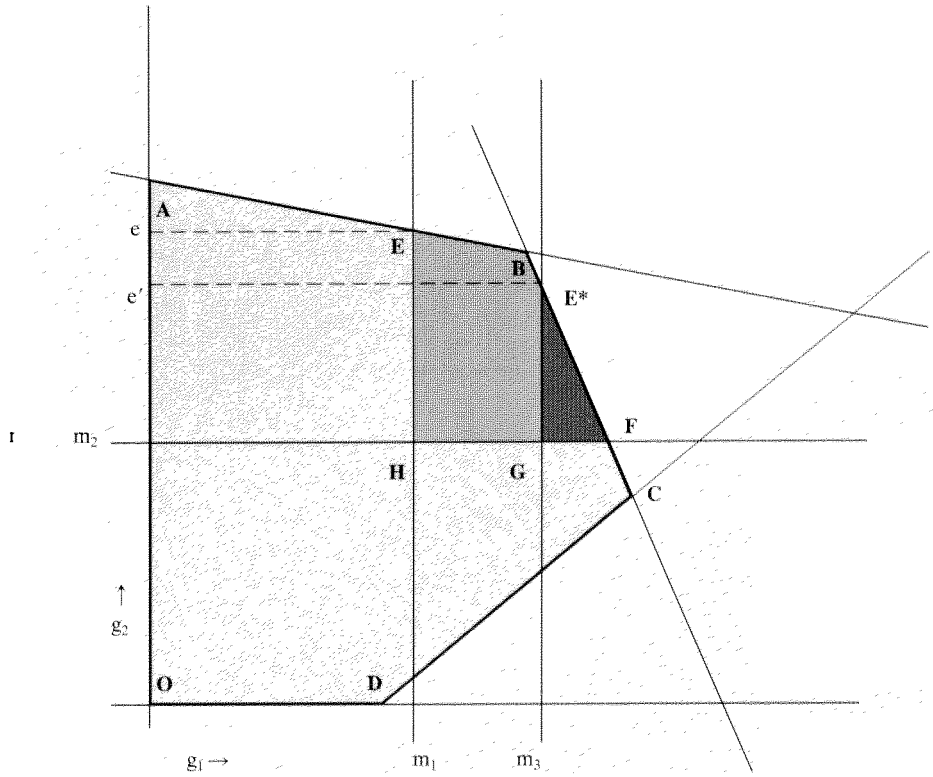
	employment	consumption
maximum attainable, separately	f	e
minimum attainable	m_1	m_2

The top line indicates the maximum attainable values for each of the goals in isolation, given the minimum values imposed. Generally speaking these values are not simultaneously attainable (in Figure 3, point M lies outside the feasible area).

The bottom line indicates which values are feasible or guaranteed in all circumstances. The combination of these two 'worst' but still acceptable values generally does lie in the permitted area (point H). As a solution this is not, however, of interest, since there are better values. The second line is simply intended to indicate the floor for each of the objectives.

The next step in the method is an interactive one, in which one of the minimum requirements is increased, while the remaining goals are once again optimized under the new, tighter restriction. In most cases this produces a lower best value than that previously attainable for the other goal variables. Figure 4 indicates the way in which this leads to a reduction in maximum consumption from e to e' if m_3 instead of m_1 is taken as the minimum level of employment.

Figure 4



In this way the costs are indicated of safeguarding a minimum level for a particular goal in terms of the maximum attainable levels for the other goals. This information can play a role in deciding which minimum requirement should next be tightened, and to what extent. In this way the goal area can be explored until only one point is left as a solution. In general, however, the analysis will be stopped at an earlier stage, leaving a goal area within which all the goals can be reasonably satisfied. The vertices of the goal area form different scenarios.

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2. *Structuur van de Nederlandse economie* (Structure of the Netherlands Economy), 1974.
3. *Energiebeleid op langere termijn* (Long-term Energy Policy,) 1974. Reports 1 to 3 are published in one volume.
4. *Milieubeleid* (Environment Policy), 1974.
5. *Bevolkingsprognoses* (Population Forecasis), 1974.
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8. *Buitenlandse invloeden op Nederland: Beschikbaarheid van wetenschappelijke en technische kennis* (Foreign Influcence on the Netherlands: Availability of Scientific and Technical Knowledge), 1976.
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10. *Commentaat op de nota Contouren van een toekomstig onderwijsbestel* (Comments on the White Paper on the Contours of the Future Education System), 1976.
11. *Overzicht externe adviesorganen vna de centrale overheid* (Survey of External Advisory Bodies of the Central Government), 1976.
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Second term of office

17. *Etnische minderheden – A. Rapport aan de Regering; B. Naar een algemeen etnisch minderhedenbeleid?* (Ethnic minorities – A. Report to the Government; B. Towards on Overall Ethnic Minorities Policy?), 1979.
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Reports nos. 13, 15, 17, 18 and 28 have translated into English; English summaries are available of Reports nos. 16, 18, 19, 20, 25, 26, 27 and 29; Report no 23 has been translated into German.