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Structural Forecasts for the Danish Economy using the Dynamic-AAGE Model

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Preface

This report documents the first set of structural forecasts of the Danish economy using the dynamic version of the Agricultural Applied General Equilibrium model of the Danish economy (Dynamic-AAGE). The report is a result of the ongoing co-operation between the Centre of Policy Studies, Monash University, Australia and the Danish Research Institute of Food Economics (FOI). It has been prepared during Dr. Philip Adams' second visit at The Danish Research Institute of Food Economics.

The report and the use of the model is an integral part of the research project "An applied Dynamic General Equilibrium Model of the Danish Economy" financed by the Danish Social Science Research Council and the research project "The Sectoral and Economy-wide Importance of the Danish Pig Production" financed by Norma og Frode Jacobsens Fond.

The report is concerned primarily with the forecasting methodology including the required inputs and the treatment of variables within the model. The intention is to produce forecasts that provide a realistic picture of the industrial structure of the Danish economy over periods of policy relevance. The forecasts are consistent with the latest medium-term macroeconomic forecasts published by The Ecoonomic Council. Also, known policy changes like the reform of the EU common agricultural policy are included in the forecasts.

Structural forecasts may be of interest to, e.g., government authorities and private organisations concerned with the prospects for particular industries. Also, the forecasts serve as a realistic base case from which to calculate how different the economy would look if a policy change, or some other disturbance, occurs in some preceding year. For example, the forecasts will serve as the base case scenario in the research project on the Danish pig production.

The report is the result of joint work between Dr Philip Adams, Monash University, and Lill Andersen and Lars-Bo Jacobsen from the Danish Research Institute of Food Economics. Research Director Søren E. Frandsen has participated in the editing process.

Danish Research Institute of Food Economic, January 2002,

Ole P. Kristensen

1. Introduction

The Dynamic-AAGE model is the dynamic version of the Agricultural Applied General Equilibrium (AAGE) model of the Danish economy.[1] Both models are maintained at the Danish Research Institute of Food Economics. Each solution of Dynamic-AAGE produces a picture of the Danish economy at a high level of detail for a particular year. The model can also produce a sequence of annual solutions, linked together by ensuring, for example, that the quantities of opening capital stocks in any year equal the quantities of closing stocks in the previous year.

Traditionally, applied general equilibrium (AGE) models like Dynamic-AAGE have been used to answer "what if" questions such as: how different would an economy look in a specified year if a policy change, or some other disturbance, had occurred in some preceding year. Typically there has been no emphasis on forecasting how the economy would look in the year of interest in the absence of the shock, or on tracing the economy's adjustment path from the time when the shock occurred to the year of interest.

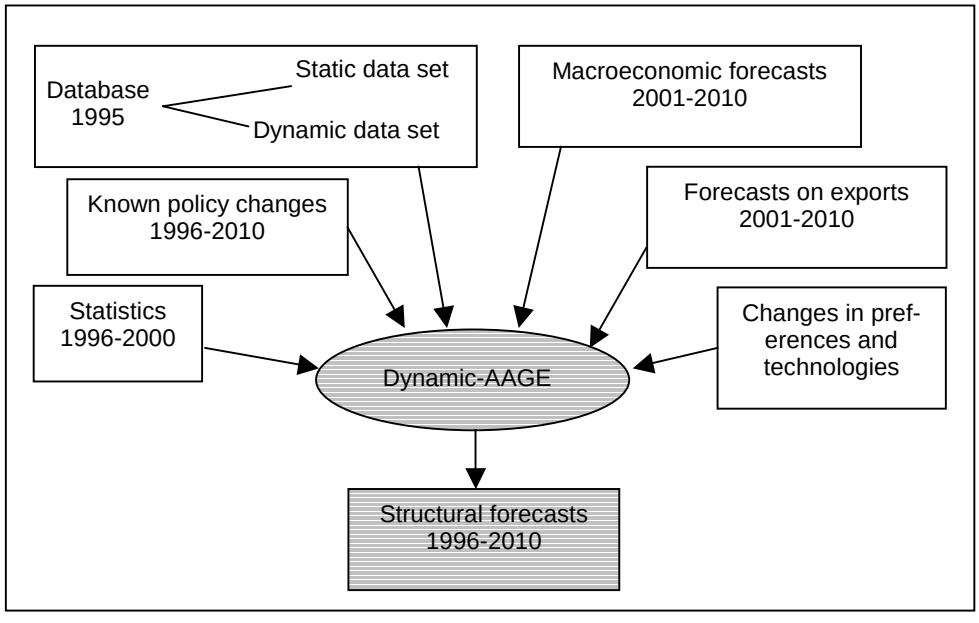
In recent years, the MONASH AGE model of the Australian economy has been used to make realistic forecasts for the economy at a high level of detail over periods of policy relevance (say up to 10 years)[2]. This work has been a source of inspiration for developing the Dynamic-AAGE to generate structural forecasts for the Danish economy. In this paper we present the first set of Dynamic-AAGE forecasts. Since the starting point for the forecasts is a database reflecting the year 1995, the forecast period covers the years from 1996 to 2010. Figure 1 illustrates the inputs required to provide the forecasts.

The authors thank John Smith, the Danish Economic Council for making the Council's forecasts available for the analysis and Søren E. Frandsen and Jens Hansen for useful comments.

1 AAGE is a development of GESMEC, see Frandsen, Hansen and Trier (1994). The developments that transform GESMEC into AAGE are outlined in Jacobsen and Frandsen (1999). The developments that transform AAGE into Dynamic AAGE are detailed in Adams (2000).
Like AAGE, Dynamic-AAGE is solved by the Johansen/Euler technique implemented through GEMPACK. GEMPACK is documented in Pearson (1998), and Harrison and Pearson (1996).

2 MONASH is a large-scale AGE model of the Australian economy built and maintained at the Centre of Policy Studies. MONASH is fully documented in Dixon and Rimmer (2000). Some examples of recent MONASH forecasts, and a description of the forecasting methodology, can be found in Adams and Parmenter (2000).

Figure 1. Forecasting flow



In addition to the database, which is split into a static and dynamic set of data, the forecasts require [3]

- Statistics for the historical period from 1996 to 2000 including national accounts statistics, international trade statistics and agricultural statistics;
- Forecasts for the future period from 2001 to 2010 supplied by the Danish Economic Council and taken from a paper prepared by the Danish Research Institute of Food Economics (FOI);
- Assumptions for changes in preferences of households and the production technologies of industries based on numbers used with the MONASH model supplemented by own analyses;
- Inclusion of known policy changes in the entire forecast period like changes in the minimum acres requirement and the reform of the EU common agricultural policy (Agenda 2000).

[3] The static data set is documented in Jacobsen (1996).

The forecasts provide a microeconomic picture that is consistent with the macroeconomic scenario and the other inputs. These forecasts may be of interest to decision makers in business and policy. Also, they serve as a realistic base case from which to calculate answers to traditional “what if” questions.

Later, in Section 6, we review aspects of the first set of Dynamic-AAGE forecasts. In the next four sections we review the inputs: Section 2 outlines the theoretical structure of the Dynamic-AAGE model, Section 3 contains an overview of the dynamic data set, our forecasting methodology is outlines in Section 4, while Section 5 reviews the inputs on macroeconomics, exports and changes in preferences and technologies. Finally, Section 7 contains conclusions.

2. The Dynamic-Aage model

This section has two parts. In Section 2.1, we review the AAGE model, concentrating on the modelling of markets, prices and demand. A very brief description of the solution procedure is given at the end of this section. The dynamic mechanisms are described in Section 2.2.

2.1. Overview of AAGE

There are five types of agents recognised in AAGE: industries, capital creators, households, governments, and foreigners. The model's current database identifies 50 industries producing 56 commodities (see Appendix A). For each industry there is an associated capital creator. The capital creators each produce units of capital that are specific to the associated industry. There is a single representative household and a government sector. Finally, there are foreigners, whose behaviour is summarised by export demand curves for Danish products, and by supply curves for international imports.

The nature of markets and prices

AAGE determines supplies and demands of commodities through optimising behaviour of agents in competitive markets. Optimising behaviour also determines industry demands for labour and capital.

The assumption of competitive markets implies equality between the producer's price and marginal cost in each industry. Demand is assumed to equal supply in all markets other than the labour market (where excess supply conditions can hold). The government intervenes in markets by imposing sales taxes on commodities. This places wedges between the prices paid by purchasers and prices received by the producers. The model recognises margin commodities (e.g., retail trade and freight) that are required for each market transaction (the movement of a commodity from the producer to the purchaser). The costs of the margins are included in purchasers' prices.

Demands for inputs to be used in the production of commodities

AAGE recognises two broad categories of inputs: intermediate inputs and primary factors. Firms in each industry are assumed to choose the mix of inputs, which minimises the costs of production for their level of output. They are constrained in their choice of inputs by nested production technologies. For the land-using industries (see Appendix A), AAGE specifies nested substitutions between:

(a) capital, labour, energy and herbicides (CLEH);
(b) land, fertiliser and insecticides (LFI);
(c) CLEH and LFI (CLEHLFI); and
(d) CLEHLFI and an aggregate of remaining intermediate inputs

For non-land using industries substitution is allowed between capital, labour and energy (CLE) and between CLE and aggregate non-energy intermediate inputs.

Household demands
The representative household buys bundles of goods to maximise a utility function subject to a household expenditure constraint. The bundles are combinations of imported and domestic goods. A Keynesian consumption function determines household expenditure as a function of household disposable income.

Demands for inputs to capital creation and the determination of investment
Capital creators for each industry combine inputs to form units of capital. In choosing these inputs, they cost minimise subject to technologies similar to that used for current production; the only difference being that they do not use primary factors. The use of primary factors in capital creation is recognised through inputs of the construction commodity.

Governments' demands for commodities
The government demands commodities. In AAGE, there are several ways of handling these demands, including: (i) endogenously, by a rule such as moving government expenditures with household consumption expenditure or with domestic absorption; (ii) endogenously, as an instrument which varies to accommodate an exogenously determined target such as a required level of government deficit; and (iii) exogenously.

Foreign demand (international exports)
Three categories of exports are defined: traditional, which are the main exported commodities, non-traditional and special export commodities (see Appendix A). Traditional export commodities face individual downward-sloping foreign demand schedules. The commodity composition of aggregate non-traditional exports is treated as a Leontief aggregate. Total demand is related to the average price via a single downward-sloping foreign demand schedule. The third category of exports comprises commodities for which special individual modelling is required.

Demand for foreign imports
For all industries, AAGE includes the standard Armington specification for imported and domestically produced inputs. This assumes that users of domestic and imported commodity i regard them as imperfect substitutes. The Armington assumption is also used in input demands for industry investment and in household demands for consumption.

Computing solutions for AAGE
AAGE is a system of non-linear equations. It is solved using GEMPACK, a suite of programs for implementing and solving economic models. A linear, differential version of the AAGE equation system is specified in syntax similar to ordinary algebra. GEMPACK then solves the system of non-linear equations as an Initial Value problem, using a standard method, such as Euler or midpoint. For details of the algorithms available in GEMPACK, see Harrison and Pearson (1996).

2.2. From AAGE to Dynamic-AAGE

There are three types of inter-temporal links incorporated into Dynamic-AAGE: physical capital accumulation, financial asset accumulation and a lagged adjustment process.

Physical capital accumulation

It is assumed that investment undertaken in year *t* becomes operational at the start of year *t+1*. Under this assumption, capital in industry *i* accumulates according to:

$$K_{t+1}(i) = (1 - DEP(i)) \times K_t\ (i) + I_t\ (i) \tag{1}$$

where:
$K_t\ (i)$ is the quantity of capital available in industry *i* at the start of year *t*;
$I_t\ (i)$ is the quantity of new capital created for industry *i* during year *t*; and
$DEP(i)$ is the rate of depreciation in industry *i*, treated as a fixed parameter.

Given a starting point value for capital in *t=0*, and with a mechanism for explaining investment through time, equation (1) can be used to trace out the time paths of industry capital stocks.

Investment in industry *i* in year *t* is explained via a mechanism of the form

$$\frac{K_{t+1}(i)}{K_t\ (i)} - 1 = F_{it}\,[EROR_t\ (i)] \tag{2}$$

where
$EROR_t\ (i)$ is the expected rate of return on investment in industry *i* in year *t*; and
$F_{it}\,[\ ]$ is an increasing function of the expected rate of return with a finite slope.

The expected rate of return in year *t* can be specified in a variety of ways. In Dynamic-AAGE two possibilities are allowed for, static expectations and forward-looking model-consistent expectations. Under static expectations, it is assumed that investors take account only of current rentals and asset prices when forming current expectations about rates of return. Under rational expectations the expected rate of return is set equal to the present value in year *t* of investing $1 in industry *i*, taking account of both the rental earnings and depreciated asset value of this investment in year *t+1* as calculated in the model.

Financial asset accumulation
The financial asset accumulation consists of net government debt and the economy's net holdings of foreign liabilities.

Since the economy engages in international trade it may accumulate external debt. The debt is updated over time by the balance on the current account. The balance on the current account is the sum of the balance on the trade account and the income account. The trade accounts is determined as the total value of exports less imports. The balance on the income account is the value of income received from foreigners less the value of income paid to foreigners. Income is the sum of interest, dividend, and transfers received/paid. In explaining movements in the income balance, the model takes into account the net interest and dividend payments on the external debt.

Over time the government's annual budget balances determine the government debt. The budget balance is calculated within the model as the difference between government revenue and expenditure. In explaining movements in the budget balance, the model takes into account the net interest payments on the stock of government debt.

Lagged adjustment process
Dynamic-AAGE includes a lagged adjustment process that relates to the operation of the labour market in year-to-year policy simulations.

In comparative static analysis, one of the following two assumptions is made about the real wage rate and employment, either:

1. the real wage rate adjusts so that any policy shock has no effect on aggregate employment; or
2. the real wage rate is unaffected by the shock and employment adjusts.

We allow for a third, intermediate position, in which real wages can be sticky in the short run but flexible in the long-run, and employment can be flexible in the short-run but sticky in the long-run. For year-to-year policy simulations, it is assumed that the deviation in the real wage rate increases through time in proportion to the deviation in aggregate employment from its basecase-forecast level. The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after about ten years. This is consistent with macroeconomic modelling in which the NAIRU is exogenous.

3. Dynamic 1995 data

The theoretical structure of the dynamic-AAGE model together with a consistent set of static and dynamic data constitutes the basis of the forecasting. The database reflects the year 1995. The static data is based upon the input-output table compiled by FOI.[4] The dynamic data set consists of data relating to the dynamic relationships: capital accumulation, net external debt accumulation and government debt accumulation. Appendix B contains an overview of the industry-specific data relating to capital accumulation while appendix C outlines the data relating to debt accumulation.

Data relating to capital accumulation

The primary source for data on capital stocks and depreciation rates is Statistics Denmark. Statistics Denmark operates with two alternative specifications of capital: gross and net capital. According to the gross specification capital is evaluated at replacement prices (prices on new capital), whereas the depreciated replacement prices are used according to the net specification. We use the gross specification since it seems to deliver the most correct measure of capital as a productive input. For example, if two capital stocks are equally productive but have different remaining lifetimes then the stock with the largest remaining lifetime will have the largest value according to the net concept. This implies that the rate of return on this capital stock is lower than the rate of return on the capital stock with the shorter remaining lifetime. This is wrong – the two capital stocks ought to generate the same rate of return. This is the case if the gross concept is used according to which the two capital stocks will have the same value and, hence, the same rate of return. Since our main objective is to measure capital as a productive input, we therefore use the gross concept.

The data published by Statistics Denmark covers the period from 1966 to 2000. It includes data on the consumption of fixed capital which is calculated according to the linear method.[5] To derive depreciation rates we calculate the average ratios between consumption of fixed capital and capital stock in the period 1966-2000.

Statistics Denmark breaks data into 53 sectors. However, this classification is not identical to the industry classification used in Dynamic-AAGE (see Appendix A). So for some industries we obtain industry-specific data by assuming identical rates of return on capital. Given this assumption, we can use the distribution of the returns to

[4] FOI constructs agricultural disaggregated I/O tables from the official tables compiled by Statistic Denmark. See Jacobsen (1996) for details on the disaggregation.

[5] According to the linear method a capital good depreciates by the same amount each year.

capital in the static data set to split an aggregated capital stock in Statistics Denmark's data into Dynamic-AAGE industry-specific capital stocks.

Data on external debt accumulation
The value and composition of Denmark's net external debt at the beginning of 1995 is obtained from the external debt statistics compiled by the Central Bank of Denmark. The trade balance is calculated based upon static data, while data relating to the income balance is part of the dynamic data set. Interest, dividend and transfer flows in 1995 are obtained from Statistic Denmark's national account statistics (accounts with the rest of the world).

Data on government debt accumulation
The government's debt constitutes the central, local and state government's and social security funds' debt net of deposits with the central bank. Data for 1995 is part of the public finances data published by Statistics Denmark.

In the model we split the government's revenues and expenditures into the following items:

- the value of income taxes collected from households;
- the total indirect tax revenue;
- revenue from taxes on capital and land;
- public consumption;
- public investment;
- returns to public investment;
- the value of government interest payments;
- the values of unemployment benefits and other transfer payments to households.

The primary source for these items are the national accounts compiled by Statistics Denmark.

4. Forecasting Methodology

Algebraically, Dynamic-AAGE takes the form

$$F(X) = 0 \qquad (3),$$

where F is an m-vector of differentiable functions of n variables X, with n>m. In simulations with (3), given an initial solution for the n variables that satisfies (3), we compute the movements in m variables (the endogenous variables) away from their values in the initial solution caused by movements in the remaining n – m variables (the exogenous variables). In year-to-year simulations the changes in the values of the exogenous variables are measured from one year to the next. If the initial solution is for year t then our first computation creates a solution for year t+1. This solution can in turn become an initial solution for a computation that creates a solution for year t+2. In such a sequence of annual computations, links between one year and the next are recognised by ensuring, for example, that the quantities of closing capital stocks in the year t-1 computation are the quantities of opening stocks in the year t computation.

In forecasting with Dynamic-AAGE, we impose on the model a large amount of information from specialist external forecasting agencies. The model is then used to trace out the implications of those external forecasts for the industrial structure of the economy.

Many of the variables tied down in the forecasting simulation would normally be endogenous in AGE simulations. But in the forecasting simulation they are exogenous, and a corresponding number of variables that would normally be thought of as exogenous are endogenous. We give three examples, two macroeconomic and one microeconomic.

1. The externally supplied macroeconomic forecasts include growth in factor inputs (aggregate employment and aggregate investment) and in aggregate real Gross Domestic Product (GDP). Hence, aggregated factor-saving/using technical change is implied (i.e., is endogenous).
2. The macroeconomic forecasts include aggregate private consumption and household disposable income (HDI). Hence, the propensity to consume out of HDI must be made endogenous

3. The FOI forecasts include export volumes for selected traditional export commodities. To accommodate these, the model must be free to project shifts in export demand schedules.

5. Exogenous variables 1996 to 2010

In generating our forecasts we begin from the latest Dynamic-AAGE database which reflects the year 1995. The first forecast simulation takes us through historical time from 1995 to 1996. We continue forecasting through historical time until we reach the year 2000. At this point we enter future time.[6] Accordingly, the variables presented in this section are separated into two parts: one referring to the historical period 1995 to 2000; the other referring to the future period 2000 to 2010.

5.1. Macroeconomic inputs

For the historical period the main data source is the national accounts published by Statistics Denmark supplemented by financial statistics published by the Central Bank. For the future period the primary source is forecasts published by the Danish Economic Council. Accordingly, both the amount of data and the levels of details differ in the two periods and so does the split between exogenous and endogenous variables. For example, the national accounts statistics include data on total compensation of employees and the government's income tax revenue. Therefore, we treat these variables as exogenous in the historical period by freeing up the wage rate and the income tax rate. In the forecast period we swap exogenous and endogenous variables.

Table 1 shows our forecasts for selected macroeconomic variables over the periods 1995 to 2000 and 2000 to 2010. All of these forecasts are either directly imposed or are implied by exogenous inputs as described above.

1995-2000 was a period of relatively high GDP-growth; the annual average being 2.8 per cent. Real private consumption grew at an average annual rate of 1.8 per cent, while the average annual rate of growth of real investment was high. In the future period we expect lower real GDP-growth, and the trend switches so that private consumption grows faster than GDP, while investment grows slower than GDP, cf. Figure 2. In the future period real GDP grows slower than in the historical period because aggregate employment growth slows down and becomes slightly negative compared to an annual average growth rate of 1.1 per cent in 1995-2000.

[6] From a forecasting viewpoint, history finishes and the future starts in the last year for which national accounts data are available. At the time of writing, this was the year 2000.

Table 1. Macroeconomic Forecast

	Variable	1995 to 2000	2000 to 2010
		--- average annual growth rates, per cent --	
1.	Real private consumption (C)	1.8	2.3
2.	Real investment (I)	6.7	1.3
3.	Real public consumption (G)	1.5	0.8
4.	International export volumes (X)	6.5	3.7
5.	International import volumes (M)	6.7	3.5
6.	Real GDP (Y)	2.8	1.8
7.	Labour supply	0.1	-0.1
8.	Aggregate employment	1.1	-0.1
9.	Aggregate capital stock	2.3	2.3
10.	GDP deflator	2.7	1.5
11.	Price of land	1.8	2.2
12.	Rental rate on capital	4.1	0.5
13.	Nominal wage	4.0	3.6
14.	Producer real wage	1.3	2.1
15.	CPI	1.9	1.3
16.	Terms of trade	1.3	-0.1
17.	Real devaluation of exchange rate	-2.2	-0.5
		---- per cent, end of period ----	
18.	Unemployment/labour supply	5.7	5.1
19.	Net external debt/GDP	12.3	-3.7
20.	Public debt/GDP	54.6	38.0

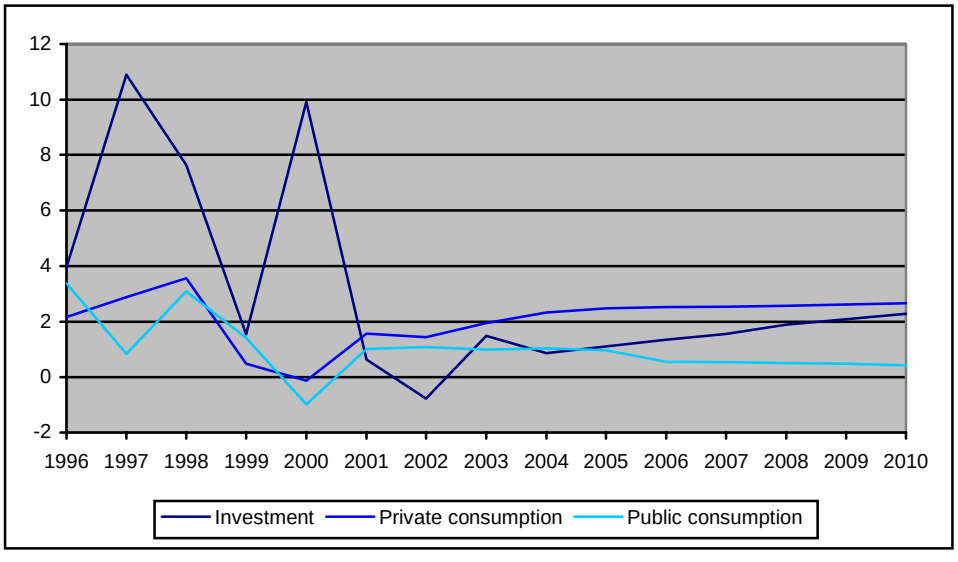
In the future period real consumption grows faster than GDP because household's disposable income grows faster while the average propensity to consume out of disposable income is approximately constant. The reason for the disposable income to grow faster than real GDP is that the nominal wage is expected to increase by 3.6 per cent per year on average in the future period while aggregate employment falls only slightly by 0.1 per cent per year. Especially in the last years of the future period the tight labour market puts an upward pressure on the nominal wage rate, cf. Figure 4.

In the historical period real investment grows at 6.7 per cent. Therefore, in 2001 the capital stock is rather high, and since real GDP growth is expected to slow down, investment growth slows even further down to 1.3 per cent per annum on average.[7]

[7] The aggregate capital stock grows at similar rates in the two periods even though aggregate investment slows down substantially. These aggregates are calculated as weighted averages of the percentage annual changes in the industry-specific capital stocks/investment levels, where the weights are the values of the industry-specific capital stocks/investment levels. Hence, due to variations between capital stocks and investment levels within industries and due to variations in growth rates across industries, growth rates of aggregate investment of 6.7 and 1.3 per cent may be accompanied by the same growth rate of aggregate capital.

In the historical period, public consumption increases by 1.5 per cent per year on average. In accordance with the government's declared goal it is assumed that public consumption increases by 1 per cent per year until 2005. From 2005 to 2010 it is assumed that public consumption moves with the demographic development implying that it increases approximately 0.5 per cent per year, cf. Figure 2.

Figure 2. Real aggregate investment private and public consumption, per cent annual growth rates

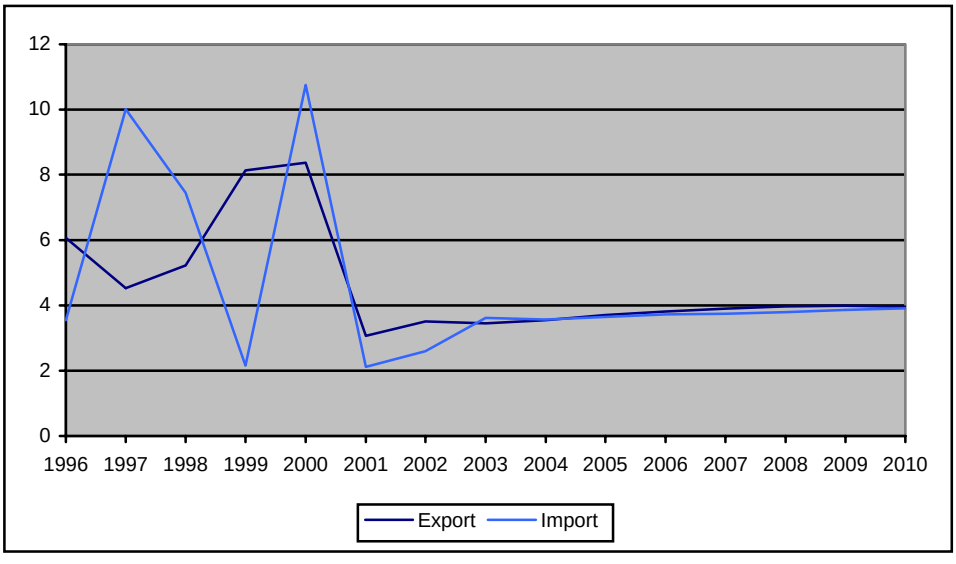


During the 15 years of consideration the contribution to GDP growth from the net volume of international trade is very small. In the historical period this is accompanied by a mild real appreciation of the exchange rate. In the future period net volume of international trade increases slightly. This requires a smaller appreciation of the real exchange rate compared to the previous period.

Figure 3 reveals very fluctuating patterns of international trade through the historical period. It also illustrates that there has been rapid growth in international trade through that period. These observations reflect several factors: fast growth in the economies of our main trading partners, improvements in communications, and the rapid but fluctuating investment growth that affects imports because investment is an import-intensive activity. In the forecast period we expect both the growth rate of our

main trading partners and the domestic investment growth rate to slow down, generating lower growth rates in international trade.

Figure 3. International trade, per cent annual growth rates



Even though real aggregate imports and exports grow at approximately the same rates, the trade balance improves over the 15 years of consideration. This is because the value of exports exceeds the value of imports by 40 bio. DKK in 1995. Hence, the value of the net external debt falls. According to our calculations the net external debt disappears in 2007, and in 2010 there is a surplus of 3.7 per cent of GDP.

In the future period the demographic development according to which the proportion of elderly to working age population is expected to increase significantly over the next 50 years is taken into account. This development implies that the labour supply decreases by 0.1 per cent per year or of approximately 40.000 people until 2010.[8] The assumptions of the labour supply and employment to decrease equally by 0.1 per cent

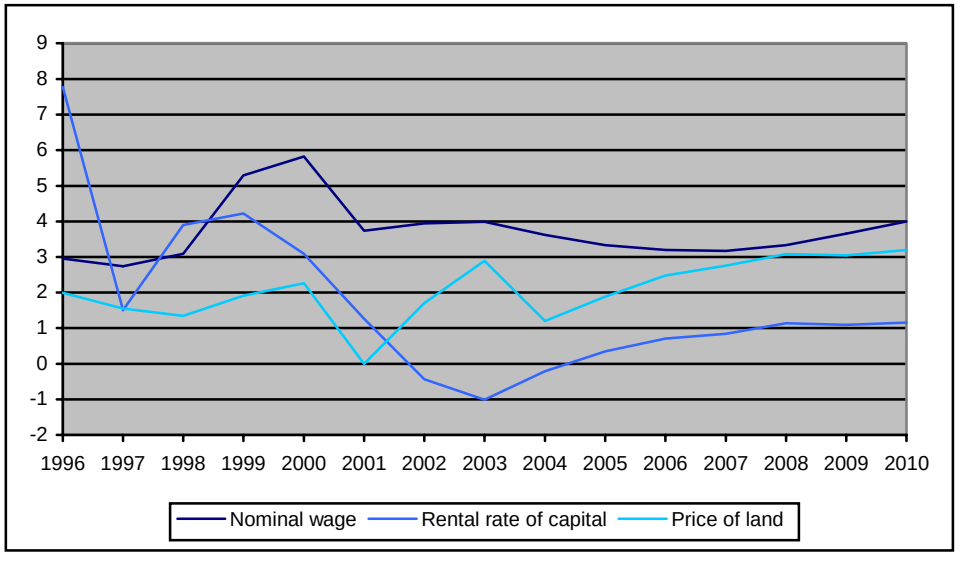
[8] The Ministry of Finance expects that the demographic development will be more than outweighted by increasing participation rates by the elderly and net-immigration. Hence, the Ministry expects the labour force to increase by 76.000 persons from 1998 to 2010.

per year implies that the unemployment rate decreases slightly from 5.7 per cent in 2000 to 5.1 per cent in 2010.

The lower growth rate of the labour-to-GDP ratio in the future period compared to the historical period implies that the marginal product of labour grows faster. Therefore, the growth rate of the producer real wage, defined as the nominal wage deflated by the price of GDP, increases from 1.3 per cent on average in the historical period to 2.1 per cent on average in the future period. However, since price inflation is expected to slow down in the future period compared to the historical period, the growth rate of the nominal wage decreases slightly from 4.0 to 3.6 per cent per year on average.

In Figure 4 it is seen that the growth rate of the industry-weighted rental rate on capital slows down substantially in the future period compared to the historical period. In the historical period the increasing employment ensures that GDP grows faster than the aggregate capital stock. For this reason the marginal product of capital increases such that the rental rate on capital increases by 4.1 per cent on average in 1995-00. In the future period the fall in employment generates an increasing capital-to-GDP ratio such that the marginal product of capital decreases and the rental rate on capital increases by only 0.5 per cent on average.

Figure 4. Primary factor prices, per cent annual growth rates



Agricultural land is used as an input into the production of crop products. But agricultural land has a secondary use in the following sectors: *I6 Meet cattle and milk, I7 Pigs, I8 Poultry* and *I9 Hunting and fur farming*, where it is used for spreading manure. This use is regulated through the minimum acres requirement, which determines how many acres are required per unit animal. In the model we assume that agricultural land may be used for both purposes simultaneously, and we take into account the set aside requirements, the hectar premiums and the minimum acres requirement. The price of land depends on the demand for land for production as well as the demand for land for spreading manure. In Figure 4 it is seen that the growth rate of the land price increases fast in 2002 and 2003. The reasons for this is that the hectare premium on cereal increases in 2002 and the minimum acres requirement increases in 2003. In the longer run the price of land stabilises at annual increases of approximately 3 per cent. This gives an annual average growth rate of the land price of 2.2 per cent in the forecast period.

Since 1997 there has been surplus on the government account. We expect this development to continue throughout the forecast period since the higher transfer expenditures due to an aging population is outweighed by lower expenditures on unemployment benefits and lower interest expenditures. Therefore, debt is reduced from 55 per cent of GDP in 2000 to 38 per cent in 2010.[9]

5.2. Assumptions for Exports

In Dynamic-AAGE, three categories of exports are distinguished: traditional, non-traditional and special exports. For traditional exports, the model specifies individual demand functions. Traditional exports include commodities, which have export shares in total sales greater than 40 per cent. For non-traditional export, the model adopts a bundle approach. A single export demand schedule explains movements in export demand as a function of an export price index. The index equals the weighted average of individual non-traditional export prices.

The third category of exports comprises commodities for which special individual modelling is required. At present, *C45. Wholesale trade*, *C47. Transport services*, and *C49. Transport and communication* are treated as special exports. The first two com-

[9] The Ministry of Finance expects public debt to be reduces to 27 per cent in 2010. We expect that the difference is due to the assumption of higher participation rates of the elderly which reduces expenditures on social pensions, and an assumption of lower unemployment rate which reduces expenditures on unemployment benefits.

modities are not true exports; they consist mainly of margin sales to facilitate exports of other commodities. Exports of transport and communication consist primarily of Danish water-transport services used outside Denmark, and charges imposed by Danish telephone companies and the Danish postal company on foreign communications companies for distributing incoming phone calls and mail within Denmark. Exports of these commodities will be incentive to changes in cost competitiveness in Denmark.

With this classification, traditional exports comprise 67 per cent, non-traditional exports 15 per cent, and special exports 18 per cent of total exports in 2000.

Table 2. Assumptions for Export Volumes

Industry	Commodity	1995 to 2000	2000 to 2010
		average annual growth rates, per cent	
Traditional export commodities			
1.	Cereal	-0.6	6.5[(a)]
10.	Hunting and fur farming etc.	4.6	1.2
11.	Horticulture	5.4	1.2
14.	Fishing	2.8	1.0
15.	Extraction of oil and gas	11.5	-12.5[(a)]
16.	Cattle-meat products	-4.4	2.6
17.	Pig-meat products	3.4	1.8
19.	Fish products	1.1	1.1
22.	Dairy products	1.4	1.2
23.	Starch, chocolate products etc.	4.1	3.0
29.	Textile, wearing apparel and leather	6.5[(a)]	4.9
32.	Oil refinery products	6.4	4.9
33.	Basic chemicals	6.1	4.9
35.	Agricultural chemicals nec	6.9	4.9
37.	Metal products	4.8	4.9
38.	Machinery & non-transport equipment	7.3	4.9
39.	Transport equipment	10.2	4.9
Special export commodities			
45,47,49		9.2	2.9
Non-traditional export commodities			
2-4,6,8,9,13,18,20,21,24,26-28,30,31,34,36,40,41,43,46,48,50		6.4	3.4

(a) Calculated within the model

In the forecast we target both the total non-traditional export volume, the volumes of traditional exports, and the volumes of special exports. Table 2 shows the average annual growth rates of the three categories of exports in the periods 1995-2000 and 2000-2010. In the historical period the sources are the international trade statistics and the agricultural statistics published by Statistics Denmark. In the future period we use

the broad forecasts calculated by the Danish Economic Council supplemented by calculations done by FOI concerning agricultural exports.[10]

The export of cereal acts like a buffer between production and domestic demand. The domestic demand stems primarily from the pig industry where it is used for feed grain. In the historical period the production of pigs grow faster than the production of cereal such that exports decrease by 0.6 per cent per year on average. In the forecast period the production of pigs slows down substantially such that the domestic demand for cereal decreases. This gives rise to an average growth rate of cereal exports of 6.5 per cent per annum.

The exports of *C10 Hunting and fur farming* and *C11 Horticulture* are assumed to grow at the general forecast growth rate of agricultural export supplied by the Economic Council. From Table 4 it can be seen that this approach implies substantial slow downs in the exports of these commodities compared to the previous period. This suggests that the chosen procedure may underestimate the export growth rates of these commodities.

Historically and in the future the exports of *C14. Fishing* and *C19. Fish products* are assumed to increase at rather low rates. This is due to a decreasing fish stock that has called for quotas and other regulations that limit the production possibilities.

Officially it is expected that the oil and gas reserves are being depleted, so unless new discoveries are made the oil and gas production in Denmark is forecast to cease by the year 2010. Therefore, we observe the significant change in the export possibilities of this commodity between the two periods. In the historical period the exports of oil and gas increases by 11.5 per cent per year while it decreases by 12.5 per cent per year in the future period.

During the last five years the export of *C16. Cattle meat* has decreased by 4.4 per cent per year on average. This trend is ascribed to the occurrence of mad cow disease and foot and mouth disease in Europe, which has caused consumers in the US and Asia to shift away from European cattle meat. In general we forecast increasing real demand for food products, and given that Europe has established channels that control the development of mad cow disease and that foot and mouth disease is under control we

[10] See Frandsen and Jensen (2000).

expect cattle meat to regain some of it's export market shares and grow at 2.6 per cent per year on average.

The export of *C17. Pig-meat products* is expected to continue to grow. Export to Scandinavia is expected to fall and the growth of export to other European countries is limited due to lower growth in income and population, and lower income elasticities in the demand for pig-meat products in the rich countries. Still, export growth of pig-meat products is assumed to be maintained at 1.8 per cent per year due to increasing exports to China and other countries outside Europe.

The export possibilities of dairy products are limited due to the milk quota. Hence, we expect the export of *C22. Dairy products* to follow the trend of increasing real demand for food products but at a rather modest rate of growth of 1.2 per cent per year. The upward trend in export of *C23. Starch, chocolate products etc.* is expected to continue, giving rise to an average annual growth rate of 3 per cent in the future period.

For traditional industrial export commodities we do not have forecasts on the exports of individual commodities. Therefore, we have applied the general forecast on industrial export supplied by the Economics Council. From Table 4 it is seen that the exports of these commodities are assumed to grow at 4.9 per cent, which is above the expected GDP growth rate of 1.6 per cent. The reason is that the international division of work implies that international trade increases much faster than the production of individual countries. Even so, we do not expect as high growth rates in the future as we have observed in the past five years due to a general slow-down of the world economy.

Special exports are assumed to grow at the annual average rate of growth in the export of services. During the last years we have observed large growth rates in services such that the average annual rate of growth is 9.2 per cent in the historical period. In the future period this growth is expected to decrease substantially to 2.9 per cent per year on average.

Non-traditional exports are assumed to grow at the rate of growth of total exports – that is 6.4 per cent in the historical period and forecast by the Economic Council to be 3.4 per cent in the future period.

5.3. Assumptions for changes in technology and tastes

Table 3 shows our assumptions for changes in the preferences of households and for changes in the production technologies of industries. The numbers are based on extrapolated trends for Australia calculated from a MONASH simulation for the period 1987 to 1996 supplemented by own analyses for the period 1995 to 2000. In the forecasting we employ the same average annual percentage change in preferences and technologies in the historical period and in the future period. This means that if we have observed a preference shift or a technological change in the historical period, then we assume that the trend continues in the future period.

Our assumptions for household tastes are summarised in the first column of numbers in Table 3. A positive (negative) number indicates that we are assuming that the household usage of the relevant commodity will increase (decrease) relative to the movements that are implied in the forecasts by changes in household aggregate expenditure and by changes in relative prices. For example, we assume that consumption of *28. Tobacco products* will fall at a rate 3.5 per cent a year faster than can be explained on the basis of changes in prices and changes in the average budget of households.

We assume a strong trend against consumption of *C17 Pig-meat products*. This is required in order for the model to generate the correct results with respect to export, import and production of pig-meat in the historical period. In this period import of pig-meat grew at an average annual rate of 19 per cent (from a very low level) while domestic consumption grew at only 0.4 per cent per year. In order to achieve this strong import growth combined with a low growth rate of domestic consumption within the model it is necessary to assume that consumption of pig-meat fall at a rate of 5 per cent a year faster than can be explained on the basis of changes in relative prices and changes in household aggregate expenditure.[11]

Among the sectors experiencing favourable shifts in consumer preferences are *20. Processed fruit and vegetable products*, and *49. Transport and communication services*. The shift towards fruit and vegetables reflect a trend towards healthier eating. The shift towards transport and communication services reflects the rapid adoption by

[11] Despite of this negative trend, relative price changes generate an average annual growth rate of consumption of pig-meat of 5.0 per cent in the future period while imports grow 3.7 per cent per annum. Hence, the import share in the local market increases from 8 per cent in 1995 to 21 per cent in 2000 ending up at 23 per cent in 2010.

Table 3. Industry Technology and Household Taste Assumptions

	Commodity	Household preferences[a]	Industry technology: Intermediate input-using[b]	Industry technology: Primary-factor using[c]
		---------- average annual, per cent ----------		
1	Cereal	0.0	0.0	-1.5
2	Oil seeds	0.0	0.0	-1.5
3	Potatoes	0.0	0.0	-1.5
4	Sugerbeets	0.0	0.0	-1.5
5	Roughage	0.0	0.0	-1.5
6	Meat cattle	0.0	0.0	-1.5
7	Milk	0.0	0.0	-1.5
8	Pigs	0.0	0.0	-1.5
9	Poultry	0.0	0.0	-1.5
10	Hunting and fur farming, etc.	0.0	0.0	-1.5
11	Horticulture	0.0	0.0	-1.5
12	Agricultural services, etc.	0.0	0.0	0.0
13	Forestry	0.0	0.0	0.0
14	Fishing	0.0	0.0	-1.5[d]
15	Extraction of coal, oil and gas	0.0	0.0	0.0
16	Cattle-meat products	0.0	0.0	-1.0
17	Pig-meat products	-5.0	0.0	-1.0
18	Poultry-meat products	0.0	0.0	-1.0
19	Fish products	0.0	0.0	-1.0
20	Processed fruit and vegetables	3.9	0.0	-2.0
21	Processed oils and fats	-1.0	0.0	0.0
22	Dairy products	1.5	0.0	-1.5
23	Starch, chocolate products, etc.	-1.5	0.0	0.0
24	Bread, grain mill and cakes	-1.5	0.0	0.0
25	Bakery shops	-1.5	0.0	0.0
26	Sugar factories and refineries	0.5	0.0	-1.0
27	Beverage production	0.0	0.0	0.0
28	Tobacco manufacture	-3.5	-1.0	0.0
29	Textile, wearing apparel and leather	-1.5	-0.5	-1.0
30	Manufactured wood and glass products	0.0	-1.0	0.0
31	Paper products and publishing	0.0	-1.0	-0.5
32	Oil refinery products	-2.7	-0.5	0.0
33	Basic chemicals	0.0	2.0	0.0
34	Fertiliser	0.0	0.5	0.0
35	Agricultural chemicals nec	0.0	0.5	0.0
36	Non-metallic building material	0.0	-0.5	-1.0
37	Metal products	0.0	1.0	-1.0
38	Machinery &non-transport equipment	0.0	2.5	-1.5
39	Transport equipment	1.0	1.0	-2.5
40	Electricity	0.3	0.9	-3.5
41	Gas	1.5	0.5	-3.0
42	Steam and hot water	0.0	0.0	0.0
43	Construction	-1.0	0.0	0.0
44	Motor vehicles service	1.0	1.0	0.0
45	Wholesale trade	-1.5	-1.0	0.0

To be continued

Table 3. Industry Technology and Household Taste Assumptions

	Commodity		Industry technology	
		Household preferences[a]	Intermediate input-using[b]	Primary-factor using[c]
46	Retail trade	-1.5	-1.0	0.0
47	Freight transport	-1.5	-1.0	-0.5
48	Financial and property services	0.5	2.5	-2.5
49	Transport and communication services	1.5	2.5	-1.5
50	Public services	-1.0	-1.0	-0.5
51	Dwelling ownership	0.0	-1.0	0.0
52	Coal imports	0.0	0.0	0.0
53	Manure	0.0	0.0	0.0
54	Fungicide	0.0	0.0	0.0
55	Insecticides	0.0	0.0	0.0
56	Herbicide	0.0	0.0	0.0

(a) Annual rate of shift of consumption function.
(b) Annual rate of change of use of the commodity identified on the left-hand panel per unit of output of industries using the commodity.
(c) Annual rate of change of use of all primary factors (labour, capital and agricultural land) per unit of production of the industry identified on the left.
(d) In 2001-2010 the parameter is freed up in order to accommodate the decrease in production by 8 per cent per year.

households of new communications products such as mobile phones. Other sectors experiencing favourable shifts are *22 Dairy products* (reversing the unfavourable trend evident in the 1980s based on concerns about consumption of high-fat products), *26 Sugar factories and refineries*, *39 Transport equipment* (increased reliance on cars for transport), *40 Electricity* (houses are becoming more electricity intensive), *41 Gas* (increasingly seen as an environmentally-safe fuel for home and transport), *44 Motor vehicle service* (consistent with the trend towards motor vehicles), and *48 Financial and property services* (increased complexities associated with banking, taxation, investment services, etc.).

We assume continuation of trends in consumer preferences against tobacco, *32 Oil refinery products* and the trade and transport sectors (*45. Wholesale trade, 46. Retail trade* and *47 Freight transport*). The trend against refinery products largely reflects the increasing fuel efficiency in cars. The trend in preferences against trade and transport reflects a number of factors, including efficiency gains in packing, and the emergence of larger supermarkets and shopping malls which are more efficient users and providers of trade and transport services.

The second column of numbers in Table 3 shows our assumptions for the average annual rates of change in the usage of commodities as intermediate inputs per unit of production in industries, and as inputs per unit of capital creation. Negative numbers indicate that technological change is commodity-saving. Positive numbers indicate that it is commodity-using. For example, we assume initially that in each year industries will increase their usage of *48 Financial and property services* by 2.5 per cent more than their outputs.[12]

An outstanding feature of our technology assumption in the second column of numbers in Table 3 is continued rapid growth in the use of high-technology products as inputs to industries. This includes inputs of electronic and other specialist equipment (part of *38. Machinery and non-transport equipment*) and inputs of communication services (part of *49. Transport and communication services*). Another industry to benefit is *48 Financial and property services*. This reflects a number of factors, including increased outsourcing of such services, and the increasing need for businesses to seek specialist help on taxation, pension and insurance.

Another interesting feature of our technology assumptions in the second column of numbers in Table 3 is the negative entries for the transport and storage industries. This reflects a number of factors including efficiency gains in packing, and changes in the nature of transported products (e.g., the rapid reduction in size and weight of electronic equipment such as computers).

Our assumptions for each industry concerning average annual changes in primary-factor usage per unit of output are shown in the final column of Table 3. Primary-factor inputs in Dynamic-AAGE comprise labour, capital and agricultural land. For example, our initial assumption for *40 Electricity* generation is that output will increase on average by 3.5 per cent a year relative to the industry's overall usage of primary factors.

In the final column of Table 3, we assume rapid primary-factor saving technical progress in communications and in electricity and gas. We assume that the reforms in

[12] The exogenous shocks to produced-input technologies impose a cost/saving on the industries that use the inputs. For example, industries that utilise financial and property services will suffer a cost increase when forced to use 2.5 per cent more of those services per unit of output. To offset these cost effects, we make a simultaneous uniform adjustment to the technology coefficients applying to all the user's inputs (produced and primary) so that there is no net effect on the user's costs.

these sectors, which commenced in the late 1980s, will continue through the forecast period. For agriculture, we assumed that primary-factor saving technical change would be about one and a half per cent. This is typical of estimates for the agricultural industries generally.

6. Projections for industry output 2001-2010

Table 4 gives output forecasts for the 50 industries distinguished in the model. The rank of each industry in the future forecast period (2000 to 2010) is shown in the first column.

The industries with the worst growth prospects are *5. Roughage, 6. Meat cattle and milk producers, 13. Fishing, 14. Extraction of coal, oil and gas, 15. Cattle-meat products* and *21. Dairy products*. These industries are projected to grow at average rates of less than 0.5 per cent per annum in the future period. The reasons for the poor growth prospects are that milk production and fishing are restricted by quotas. The quotas limit the growth possibilities in the primary industries as well as in the main input supplying industries and the associated manufacturing industries. Industry *14. Extraction of coal, oil and gas* are limited by natural resources, which are forecast to deplete rapidly in the future.

Industries *32. Basic chemicals, 34. Agricultural chemicals, 36. Metal products, 37. Machinery and non-transport equipment* and *38. Transport equipment* face the best growth prospects in the future. There are two main reasons for this. First these industries are highly export oriented with good export growth prospects, and second some of the industries benefit from favourable shifts in industry technologies.

The largest industry in the database is *47. Financial and property services*. Even though this industry exports only a fraction of its output it is projected to grow above average in the future. The reason is that we have assumed shifts in consumer preferences and in industry technology towards the use of financial and property services.

Charts 1-50 illustrate the development of the production as well as domestic consumption, exports and imports of each industry where relevant in the future forecasting period. For the primary and secondary food-producing industries the charts are included in the text, while the charts for industries 23-50 are found in Appendix F.

We work through Table 4 in industry order. In our discussion we make use of data in Appendix D and E, which show simulated-2000 values for the sales and cost patterns of individual commodities and industries. For industries where the dynamics are important we refer to Charts 1-50.

Table 4. Industry Output

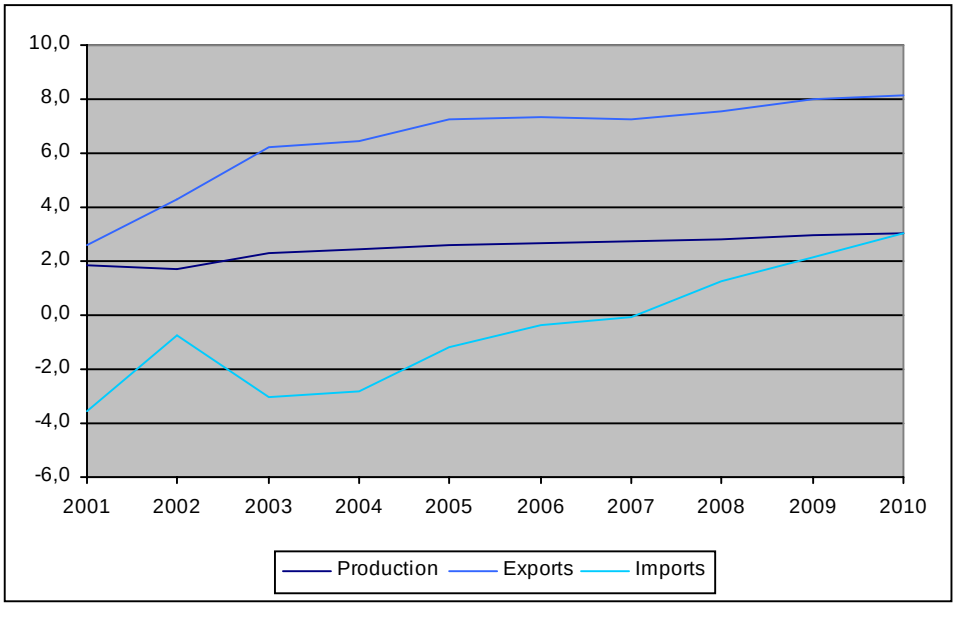
Rank		Industry	1995 to 2000	2000 to 2010
			- average annual growth rates, per cent -	
18	1	Cereal	1.1	2.5
28	2	Oil seeds	-2.7	2.0
21	3	Potatoes	1.9	2.4
24	4	Sugerbeets	2.8	2.3
48	5	Roughage	-0.1	0.0
47	6	Meat cattle and milk producers	0.0	0.2
39	7	Pigs	1.6	1.1
16	8	Poultry	3.8	2.7
34	9	Hunting and fur farming, etc.	2.7	1.6
36	10	Horticulture	2.6	1.4
41	11	Agricultural services, etc.	1.4	1.0
17	12	Forestry	3.6	2.6
49	13	Fishing	-5.5	0.0
50	14	Extraction of coal, oil and gas	2.1	-8.0
46	15	Cattle-meat products	-0.6	0.2
38	16	Pig-meat products	1.7	1.2
11	17	Poultry-meat products	5.5	3.3
40	18	Fish products	0.0	1.1
7	19	Processed fruit and vegetables	3.5	3.8
20	20	Processed oils and fats	3.3	2.4
45	21	Dairy products	0.3	0.4
31	22	Starch, chocolate products, etc.	1.4	1.9
26	23	Bread, grain mill and cakes	2.6	2.0
44	24	Bakery shops	0.5	0.5
19	25	Sugar factories and refineries	3.2	2.5
24	26	Beverage production	2.2	2.3
29	27	Tobacco manufacture	2.8	1.9
12	28	Textile, wearing apparel and leather	-0.5	3.2
32	29	Manufactured wood and glass products	3.4	1.8
37	30	Paper products and publishing	1.7	1.4
8	31	Oil refinery products	3.7	3.7
2	32	Basic chemicals	4.5	4.3
14	33	Fertiliser	1.9	2.7
4	34	Agricultural chemicals nec	4.6	4.2
35	35	Non-metallic building material	3.6	1.6
5	36	Metal products	3.5	4.1
1	37	Machinery & non-transport equipment	6.0	4.6
3	38	Transport equipment	6.9	4.2
9	39	Electricity	4.0	3.6
30	40	Gas	3.2	1.9
15	41	Steam and hot water	2.4	2.7
33	42	Construction	5.0	1.6
13	43	Motor vehicles service	3.5	3.2
27	44	Wholesale trade	3.6	2.0
43	45	Retail trade	0.6	0.7
23	46	Freight transport	3.9	2.3
10	47	Financial and property services	4.5	3.5
6	48	Transport and communication services	6.3	3.8
42	49	Public services	1.5	0.8
25	50	Dwelling ownership	1.5	2.1

1 Cereal (ranked no. 18)

The cereal industry is like other agricultural industries regulated through the common agricultural policy in the EU (CAP). When calculating forecasts for the cereal industry we take into account the hectar premiums and the set aside requirements. In 2000, nearly half of the output of the cereal industry was sold as feed grain to the pigs industry (industry 7). Of the rest, 20 per cent was exported. Imported cereals accounted for almost 12 per cent of the local market.

The cereal industry is characterised by substantial international competition implying that the domestic price of cereal is virtually fixed at the world market price level. In the forecast period we assume that the world market price grows slower than the domestic GDP deflator. Therefore, the domestic price of cereal also grows slower than the GDP deflator such that the growth prospects for cereal production are above those of the economy as a whole. Since the production of pigs grows slower than the production of cereal, an increasing proportion of total cereal production is exported in the forecast period, cf. Chart 1.

Chart 1. Cereal, per cent

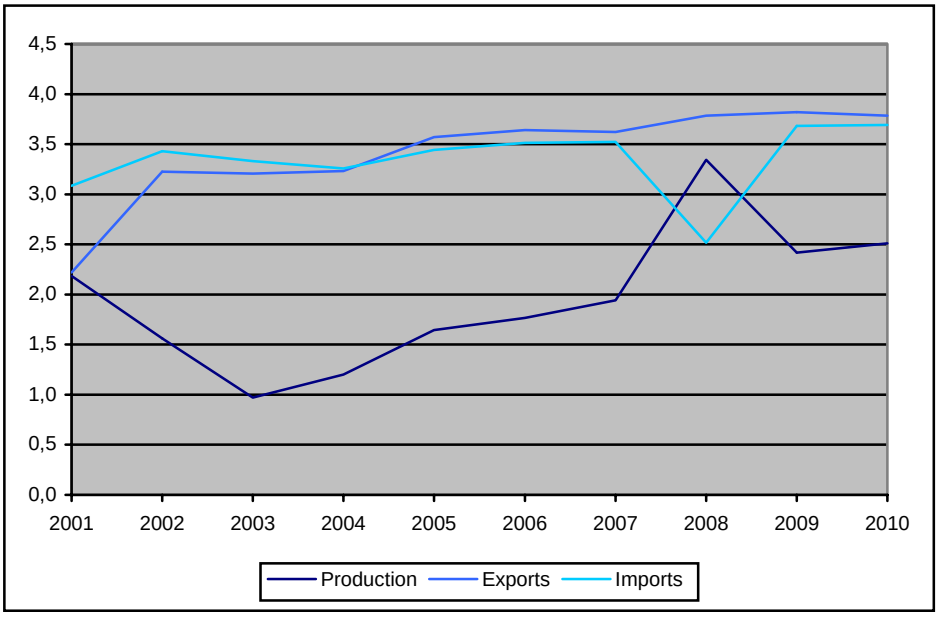


2 Oil seeds (ranked no. 28)

The oil seeds industry produces mainly for downstream food industries, *19 Processed fruit and vegetables* and *20 Processed oils and fats*. It has quite extensive trade exposure. Fifty per cent of its production is exported, while imports supply 60 per cent of the local market.

As part of Agenda 2000 the hectare premium on oil seeds production decreases in 2001 and 2002. Therefore we observe relatively low growth rates of oil seeds production in the first years of the forecast period, cf. Chart 2. On average the production of oil seeds grow at 2.0 per cent in this period.

Chart 2. Oil seeds, per cent

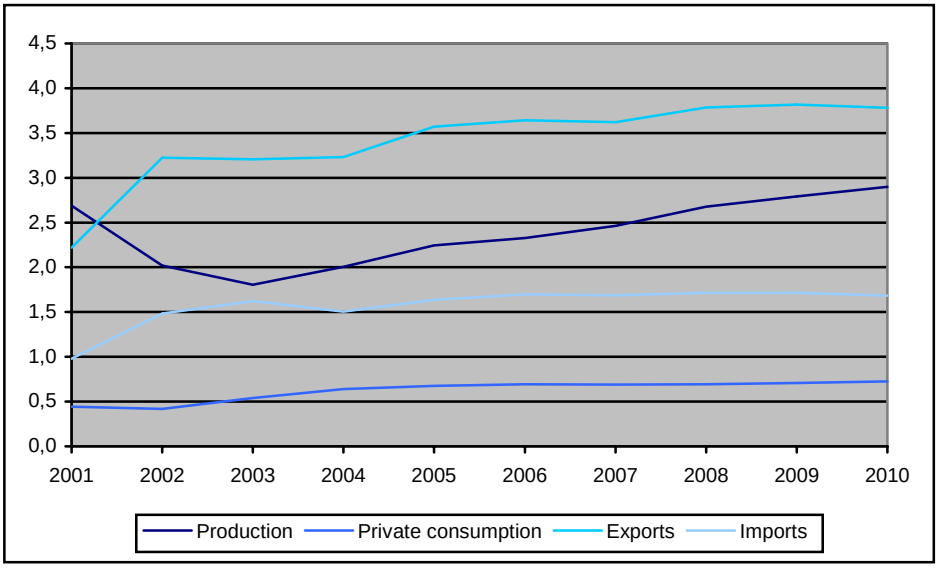


3 Potatoes (ranked no. 21)

Unlike the other primary agricultural industries, a significant proportion (around 20 per cent) of the production of potatoes is sold to households for consumption. The bulk of the remaining sales go to *19 Processed fruit and vegetables* and to exports (25 per cent of total sales).

Potato production is forecast to grow at an average annual rate of 2.4 per cent. This relatively high rate is primarily due to good export prospects (cf. Chart 3). Private consumption of potatoes is forecast to expand at the rate of 0.6 per cent. This is below total private consumption, which is forecast to growth at an average annual rate of 2.3 per cent (Table 1). Potatoes, however, has a relatively low expenditure elasticity in consumption, causing growth in consumption demand for this product to be less than growth in total consumption.

Chart 3 Potatoes, per cent

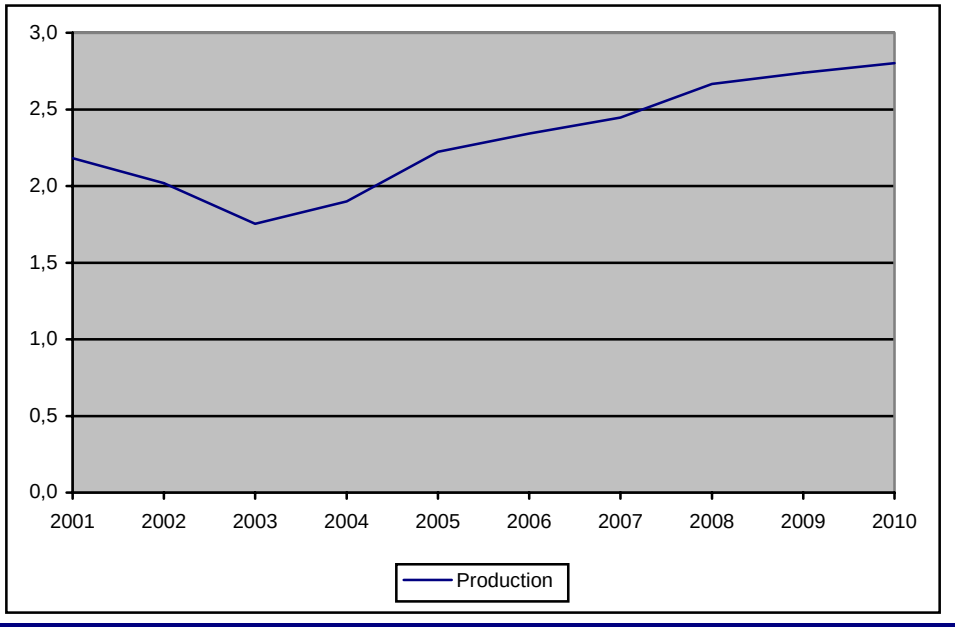


4 Sugarbeets (ranked no. 24)

Sugarbeet is an internationally non-traded commodity, produced primarily for manufacture by sugar refineries (industry 25). Nearly 80 per cent of its output is sold to sugar manufacture, with the rest going to *19 Processed fruit and vegetables.*

Over the years the annual growth in this industry matches that of the sugar refineries industry, cf. Charts 4 and 25. The forecast growth is 2.3 per cent on average which is somewhat below its historical growth rate of 2.8 per cent. This is in line with production of refined sugar, which is forecast to grow at an annual rate of 2.5 per cent, compared with growth of 3.2 per cent in the historical period.

Chart 4 Sugarbeets, per cent

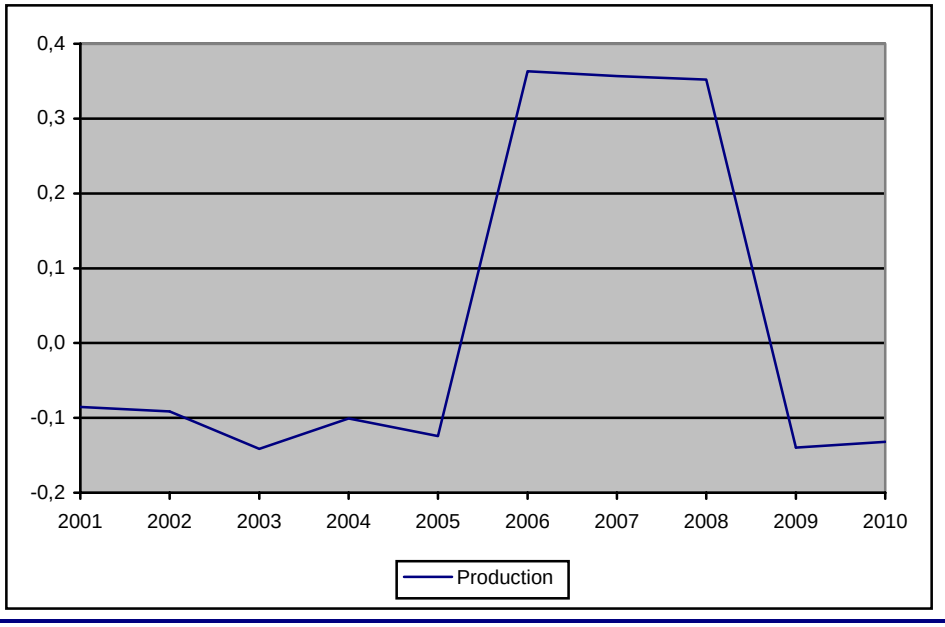


5 Roughage (ranked no. 48)

Roughage is produced solely for use in *6 Meat cattle and milk producers*. There are no exports, nor imports.

Production of roughage declined between 1995 and 2000 at an average annual rate of 0.1 per cent. We expect a similar rate of decline over the forecast period except in 2006-8, cf. Chart 5. The increase in production in these years is due to changes in the milk quota.

Chart 5 Roughage, per cent

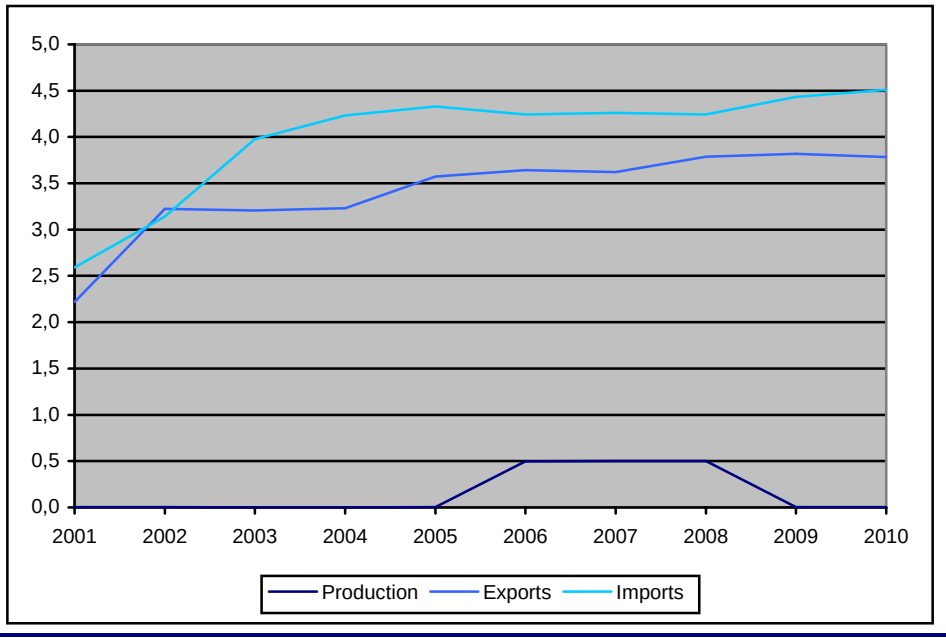


6 Meat cattle and milk producers (ranked no. 47)

This industry produces two products, cattle for slaughter and milk, which are produced in fixed proportions. Cattle are sold to *15 Cattle-meat products.* Milk is sold either fresh or for manufacturing to *21 Dairy products.* About 8 per cent of meat cattle are exported. Meat cattle face some import competition on local markets, but imports of milk are negligible.

Production in this industry is constrained by a quota on the production of milk. The quota will increase by annually 0.5 per cent over three years in 2006-8 as part of the reform of the CAP. In the rest of the forecasting period the quota will remain at its current level, implying zero change in meat cattle and milk production, cf. Chart 6.

Chart 6 Meat cattle and milk producers, per cent



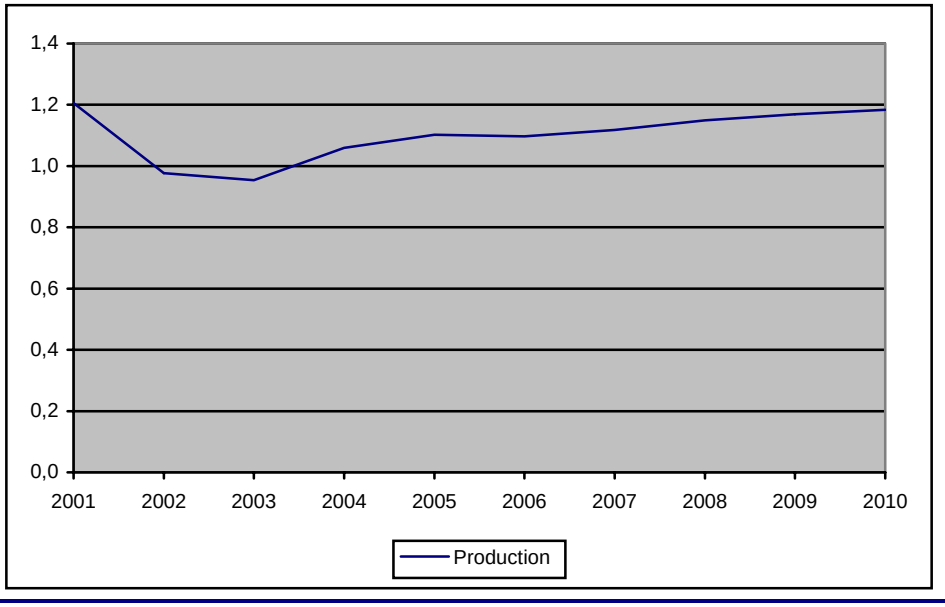
7 Pigs (ranked no. 39)

This is the largest primary agricultural industry. Nearly all of its production goes to the downstream manufacturing industry (*16 Pig-meat products*). Although the industry does not export directly, it is highly exposed to export competition via its connection to the export-oriented pig-meat industry.

In line with our forecast for *16 Pig-meat products*, we expect the annual rate of production growth for pigs to fall from 1.6 per cent per annum in the period 1995 to 2000, to 1.1 per cent in the period 2000 to 2010.

The dynamics matches those of the pig meat industry, cf. Charts 7 and 16. The observed slowdown of the growth rate in 2002-3 may be ascribed to an increase in the minimum acres requirement which causes production growth to fall and the use of land for manure to increase. In the longer run the demand for pig meat (both domestic and foreign) causes the growth rate to increase slightly.

Chart 7 Pigs, per cent.

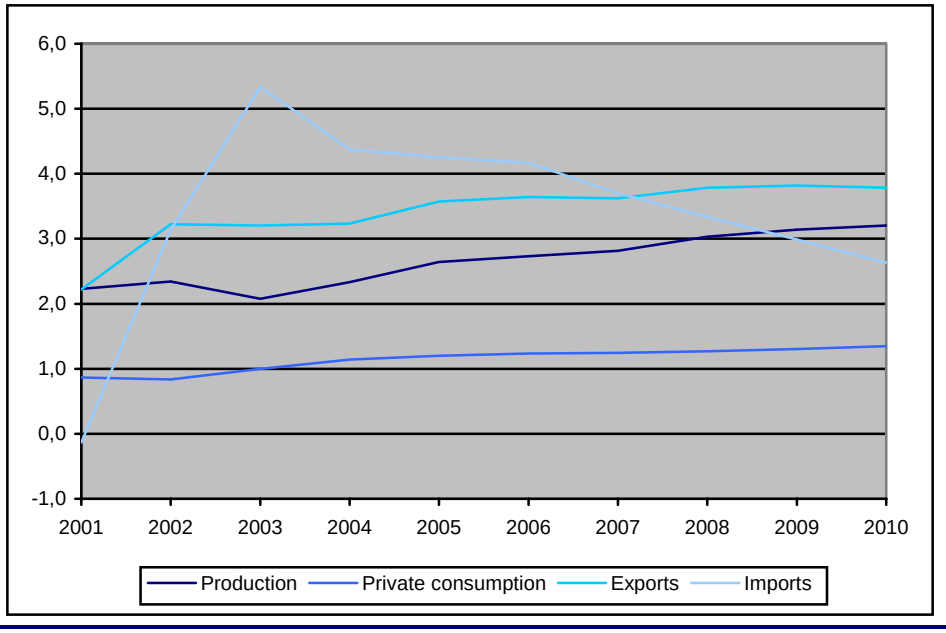


8 Poultry (ranked no. 16)

Poultry essentially produces two products: animals for processing and eggs. The latter are sold predominately to consumption. The former is sold to *18 Poultry-meat products*. Eight per cent of the combined output of the industry is exported. Likewise, imports make up 8 per cent of domestic sales.

We expect poultry production to increase at an average annual rate of 2.7 per cent, compared with growth of 3.8 per cent in the historical period. Lower growth is consistent with our forecasts of reduced growth in *17 Poultry-meat products.* From Chart 8 it is seen that low growth in the private consumption of eggs keeps the growth rate of primary poultry below that of the poultry-meat industry.

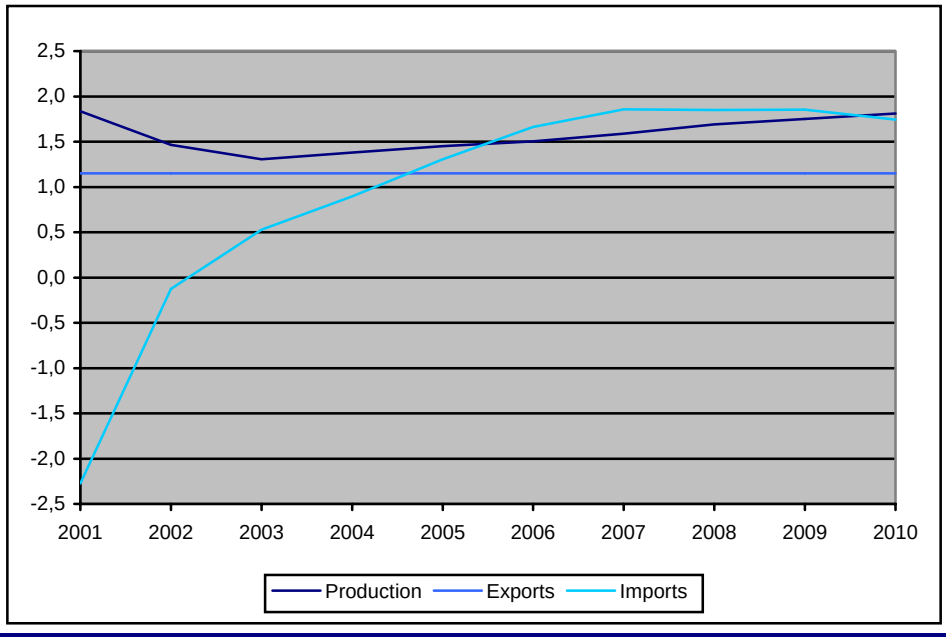
Chart 8 Poultry, per cent



9 Hunting and fur farming, etc. (ranked no. 34)
This is a highly trade exposed industry. Exports comprise 65 per cent of its total sales, while import penetration on the local market is 32 per cent. There is only one domestic customer, *28 Textile, wearing apparel and leather*.

We assume growth of 1.2 per cent in exports (Table 2). From Chart 9 it is seen that we expect increasing import penetration. Despite these factors, our forecast for annual production growth in this industry is 1.6 per cent on average. This reflects relatively strong growth in demand from the industry's major industrial customer *28 Textile, wearing apparel and leather*. Production in this industry is forecast to increase at an annual rate of 3.2 per cent.

Chart 9 Hunting and fur farming etc., per cent

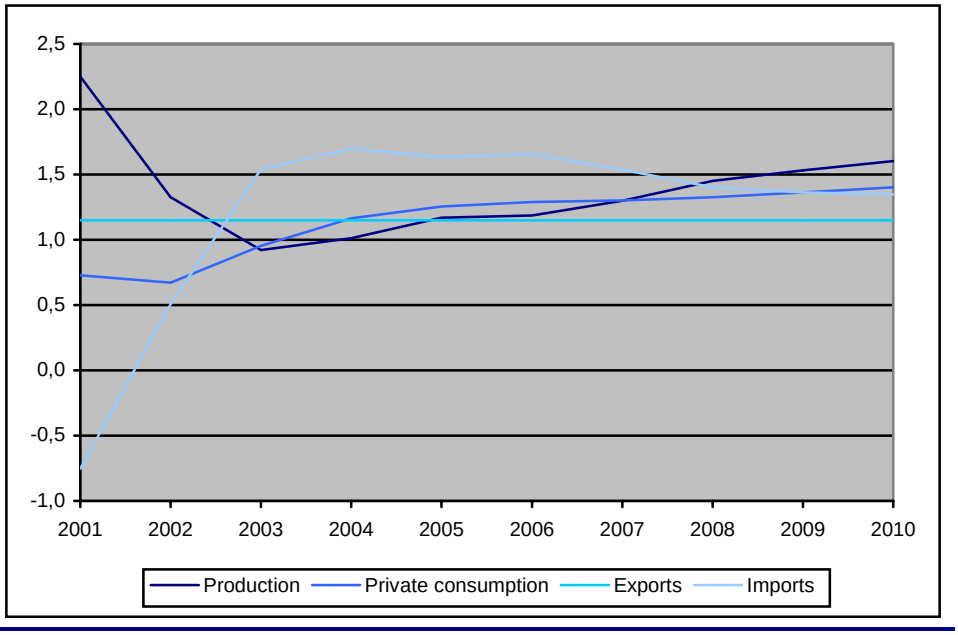


10 Horticulture (ranked no. 36)

Like industry 9, this is a highly trade exposed sector, with half its production exported, and with imports comprising over half of all sales on the local market. Most domestic sales (31 per cent) are to households, with the remainder being sold to a range of industries, including *19. Processed fruit and vegetables.*

Relative slow export growth (Table 2), increasing import penetration (Chart 10) and a low-income elasticity in consumption combine to give this industry relatively weak growth prospects. We forecast average growth in production for horticulture of 1.4 per cent per annum

Chart 10 Horticulture, per cent

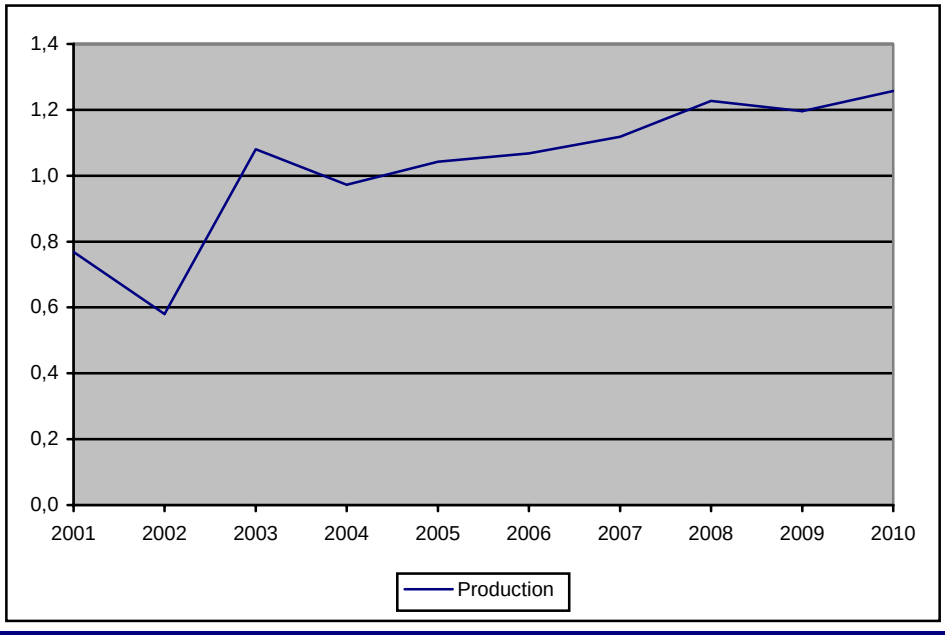


11 Agricultural services (ranked no. 41)

As the name suggests, this industry sells to all the primary agricultural industries. It does not export, nor does it face competition from imports.

In line with our forecast of a general downturn in growth for agricultural industries, we are forecasting an average-annual growth rate for this industry of only 1.0 per cent on average.

Chart 11 Agricultural services etc., per cent

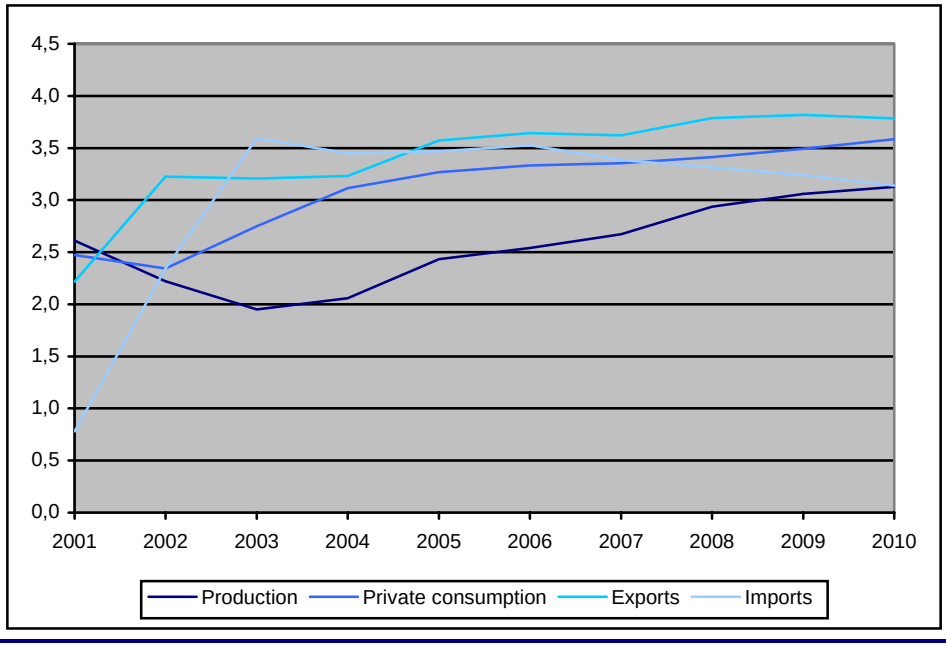


12 Forestry (ranked no. 17)

This industry produces two related products. The first is forestry services used to maintain forests. The second is logs sold to downstream manufacturers such as *29 Manufactured wood and glass products.* Forestry services are sold to the industry itself or to consumers.

Our forecast average-annual growth rate for this industry is 2.6 per cent. This compares to growth of 3.6 per cent between 1995 and 2000. The main reason for reduced growth is a downturn in domestic sales of wood to *29 Wood manufacturers* and increasing import penetration (Chart 12).

Chart 12 Forestry, per cent

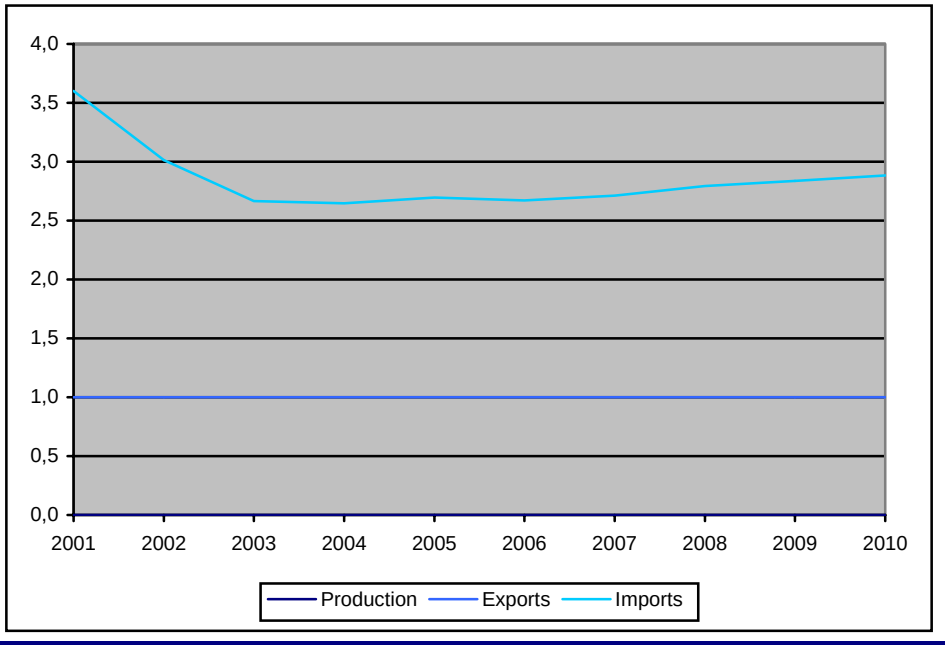


13 Fishing (ranked no. 49)

This is a very trade-exposed industry, with almost 75 per cent of its production exported, and with imports meeting over 64 per cent of domestic demand. Fishing products not produced for export are sold mainly to downstream processors in *18 Fish Products.*

Due to a gradually more restrictive quota in the historical period, fishing output fell by 30 per cent in that period. We assume that the quota will remain in place at its current level through the forecast period, implying zero change in fishing output. Since export is expected to grow at 1 per cent per annum (Table 2), this gives rise to increased import penetration (Chart 13).

Chart 13 Fishing, per cent

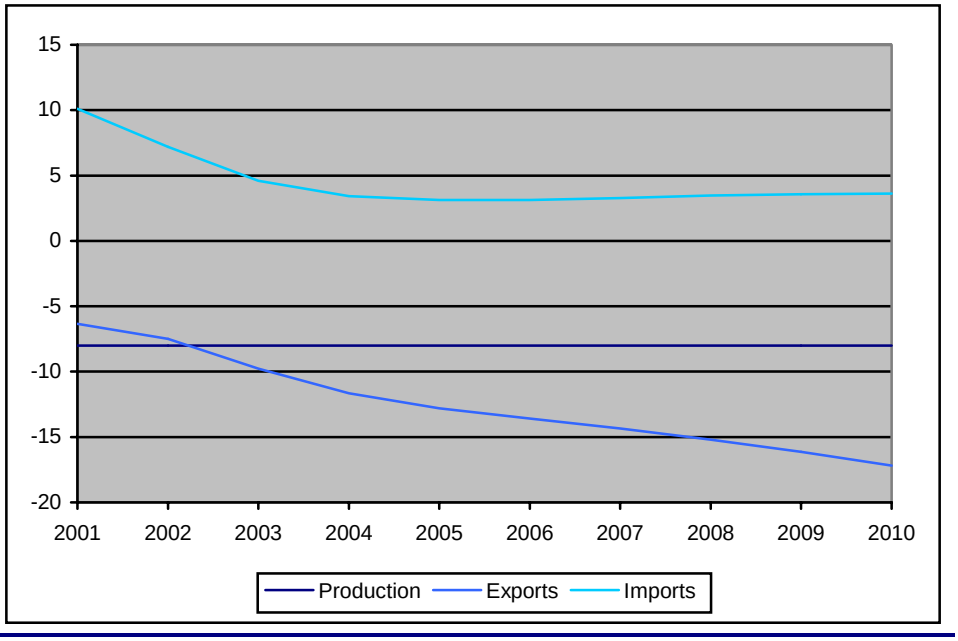


14 Extraction of coal, oil and gas (ranked no. 50)

This is the only mining industry identified in the current database. It produces oil and gas. Exports are an important source of sales, and imports comprise a large share of the local market (especially sales to electricity generators). The most important industrial customer is *31 Oil refinery products.*

We assume that production of oil and gas will fall at an annual rate of 8 per cent through the forecast period. This reflects official forecasts of the rate at which known reserves are being depleted. Unless new discoveries are made, oil and gas production in Denmark is forecast to cease by the year 2010. For this reason the export of oil and gas decreases rapidly during the forecast period while import grows at approximately 5 per cent per year, cf. Chart 14.

Chart 14 Extraction of coal, oil and gas, per cent

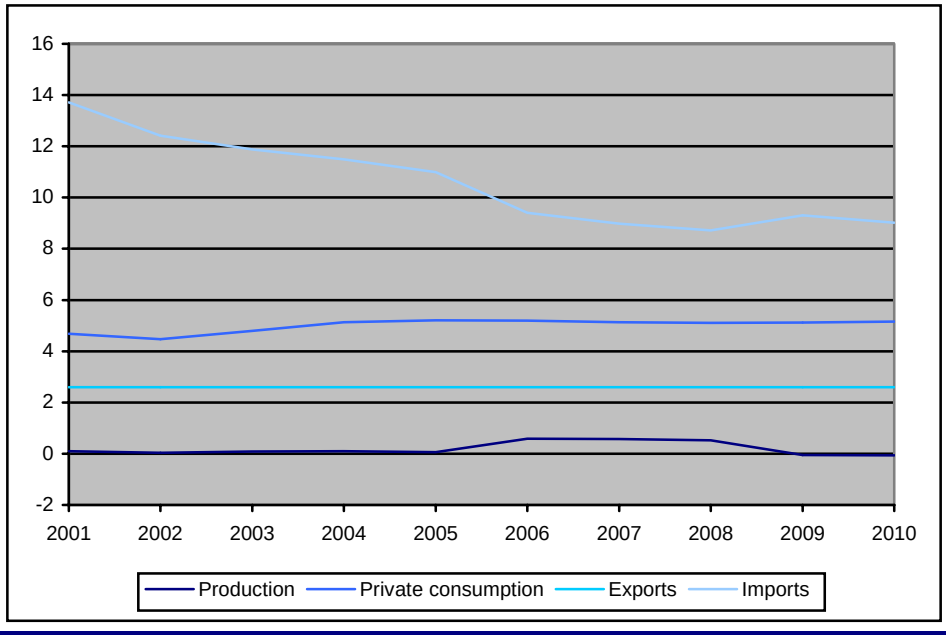


15 Cattle-meat products (ranked no. 46)

This industry purchases meat cattle for slaughter and for further processing. Most of its production is exported, with only about 40 per cent destined for the local market (mainly household consumption). The share of imports in the local market is over 40 per cent.

Between 1995 and 2000, exports of cattle meat fell at an average annual rate of 4.4 per cent (Table 2). However, meat production fell by only 0.6 per cent, as domestic producers were able to increase their share of the local market. In our forecasts, we assume a recovery in export growth, but little change in production. This reflects, in the main, the milk quota that restricts production of milk and cattle for slaughter. With exports rising and little change in production, import penetration is forecast to increase, cf. chart 15.

Chart 15 Cattle-meat products, per cent

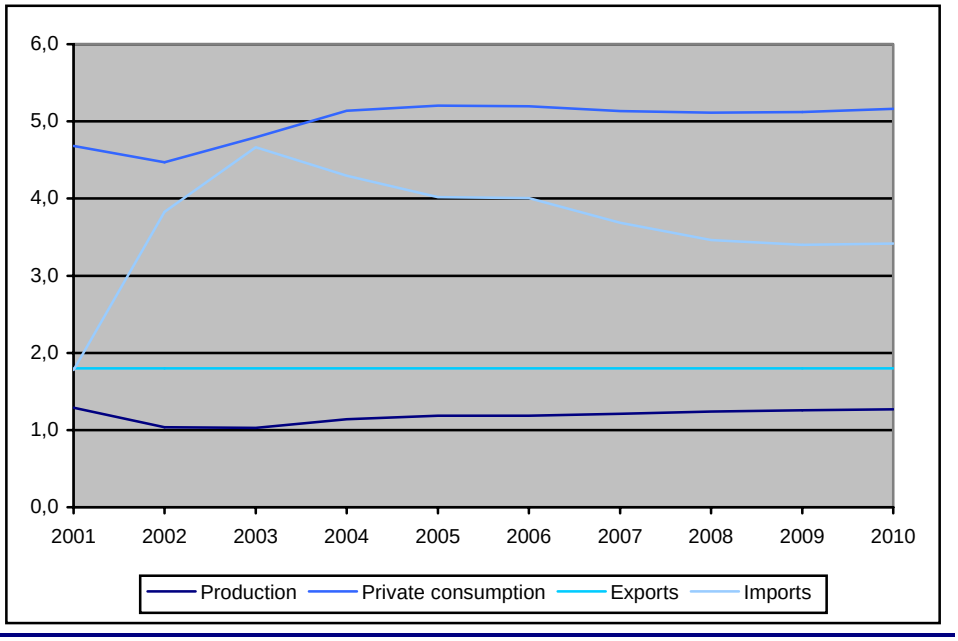


16 Pig-meat products (ranked no. 38)

This is, by far, the largest meat processing industry. It is highly export oriented, with 64 per cent of its production being exported. In 2000, 16 per cent of production was sold to consumption. This share has fallen from 18 per cent in 1995 due to increased import penetration.

We expect this trend to continue in the forecast period such that production grows at an annual average rate of 1.2 per cent while import grows at 3.7 per cent on average (Chart 16). In making this forecast, we assume that exports will grow by 1.8 per cent per annum (Table 2). Hence, increased import penetration as well as relatively poor export prospects combine to generate lower production growth in the forecast period compared to the historical period.

Chart 16 Pig-meat products, per cent

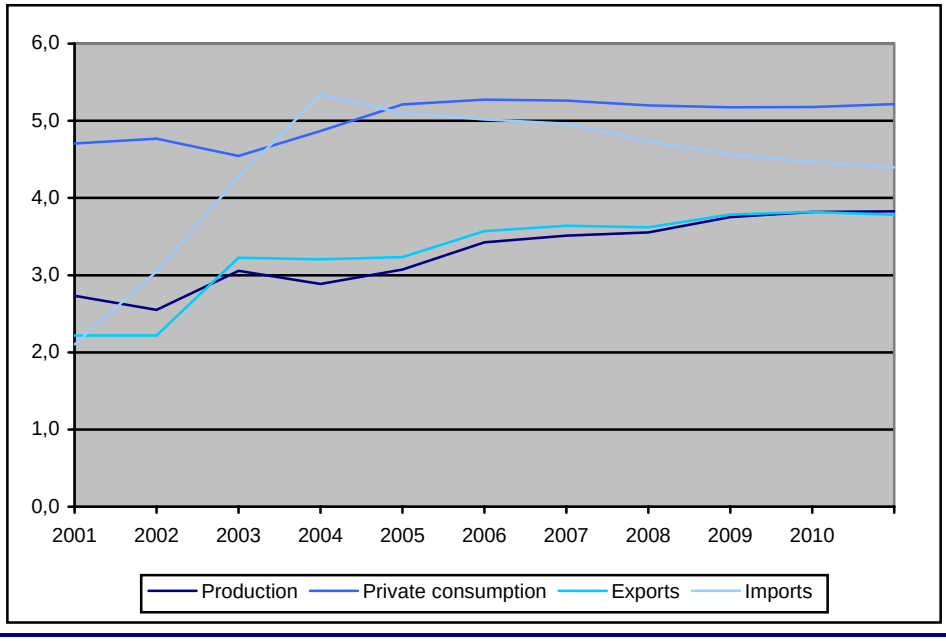


17 Poultry-meat products (ranked no. 11)

Poultry meat is mainly produced for export. Most domestic demand is met from imports.

Production of poultry meat is forecast to grow at an average annual rate of 3.3 per cent. This is considerably below its historical rate of growth, but is above the forecast growth rates of other meat producers. The reason for this is that poultry meat is treated as a non-traditional export commodity such that we forecast exports of poultry meat to increase in line with the forecast growth rate of non-traditional exports, namely at an annual rate of 3.4 per cent.

Chart 17 Poultry-meat products, per cent

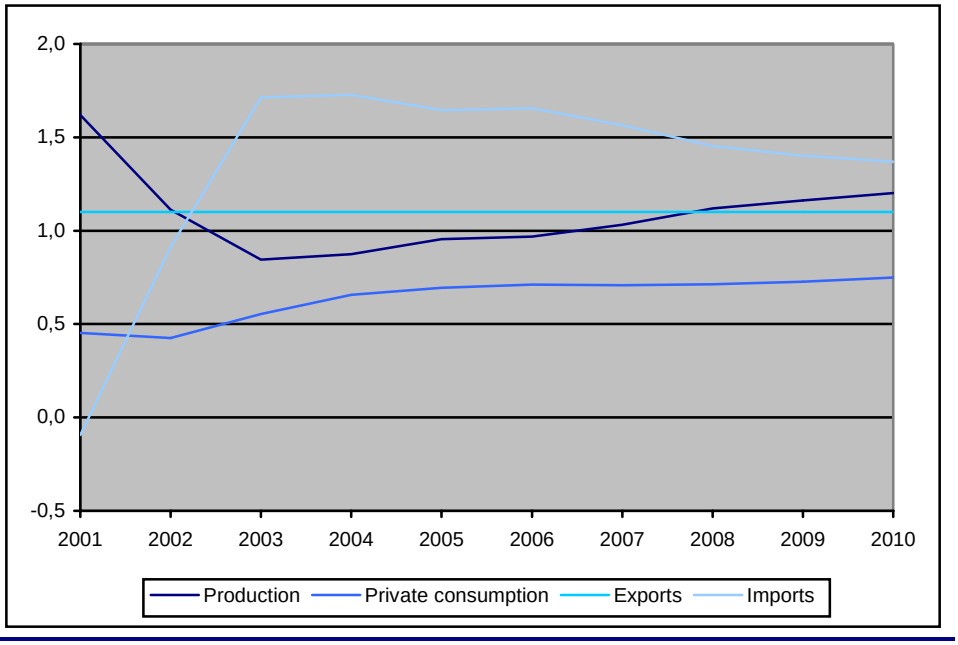


18 Fish products (ranked no. 40)

Like the animal-meat industries, the fish-products industry is strongly oriented towards exports, with 70 per cent of its production exported. Also, common with its animal counterparts, imports comprise a large share of the domestic market.

Production of fish products is forecast to increase by 1.1 per cent per year. This reflects our assumption for exports (Table 2).

Chart 18 Fish products, per cent



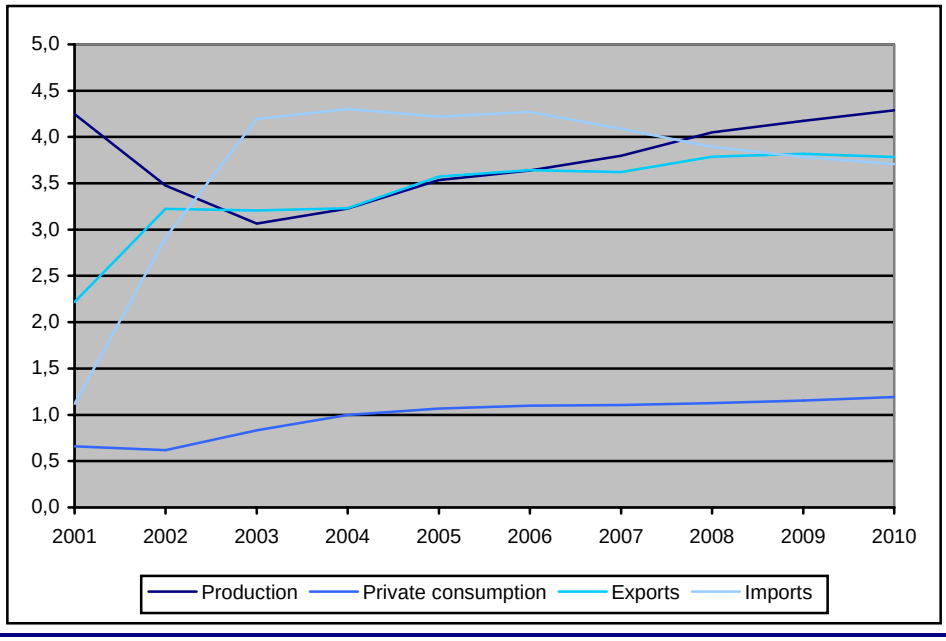
19 Processed fruit and vegetables (ranked no. 7)

This industry is more domestic oriented than the other food processing industries, with only about a quarter of its production exported. The main source of domestic demand is household consumption. An important industrial customer is *47 Financial and property services*, which includes the operations of restaurants and hotels.

Our forecast for output growth in this industry is 3.8 per cent per year on average, higher than any other primary and secondary agricultural industry. The industry owes its relatively high ranking to two factors. First, we are assuming that the industry's products will benefit from favourable shifts in consumer preferences (Table 3), reflecting the continuation of trends towards healthier eating. Second, we are forecasting relative strong growth in the industry's major industrial customer, *47 Financial and property services.*

From Chart 19 it is seen that in 2001 the industry grows almost 4.5 per cent in 2001 but as time goes the import competition in the market for processed fruit and vegetables increases.

Chart 19 Processed fruit and vegetables, per cent

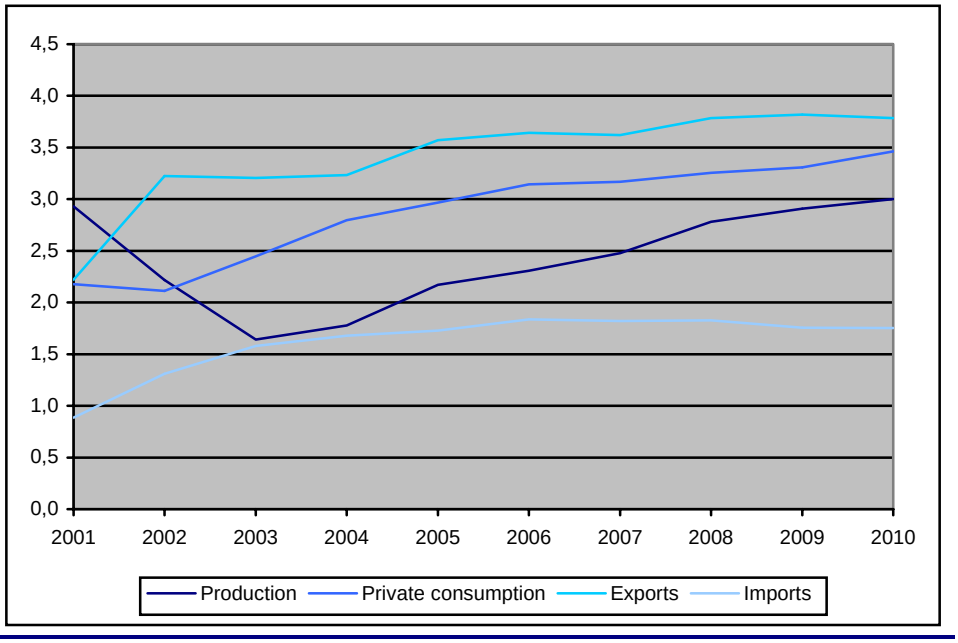


20 Processed oils and fats (ranked no. 20)

This industry produces product for human consumption, and supplementary feed for animals, especially pigs. Over half of production goes to industries, though most of the industrial demand is met from imports.

Our forecast average growth rate for this industry is 2.4 per cent per annum. The production growth is maintained primarily due to the fact that we expect exports of processed oils and fats to increase at the annual rate of 3.4 per cent, in line with the forecast growth rate of non-traditional exports, cf. chart 20.

Chart 20 Processed oils and fats, per cent



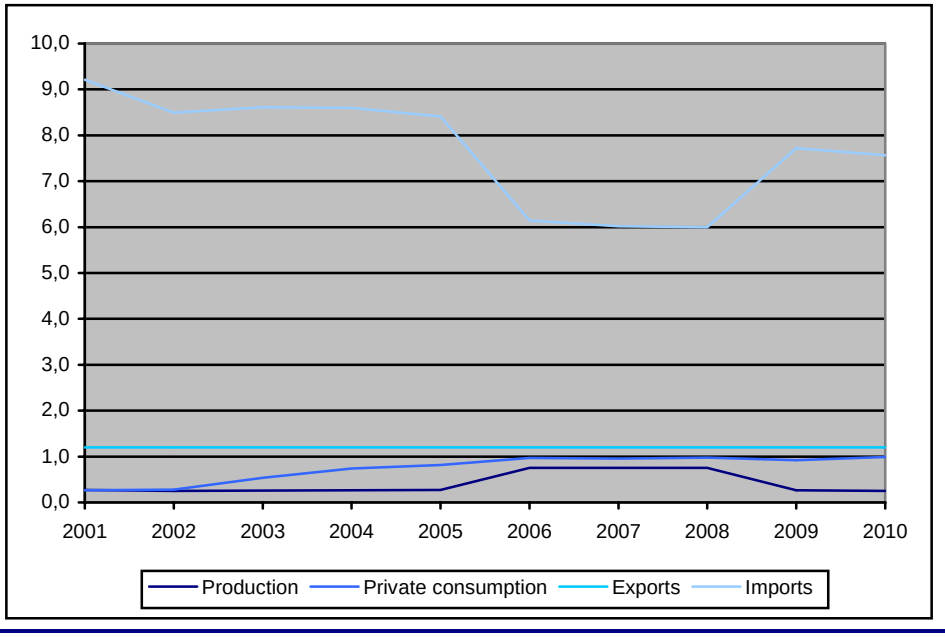
21 Dairy products (ranked no. 45)

This industry produces fresh milk and manufactured milk products. Fresh milk is sold to domestic households, while manufactured milk products are primarily exported. Import penetration on the local market is comparatively mild (just over 20 per cent).

Production growth in the dairy industry is tightly constrained by the production quota on milk production. In our forecasts dairy output growth is projected to be 0.4 per cent per annum, reflecting increased efficiency in the manufacture of milk products from an unchanged supply of primary input.

Chart 21 illustrates the effects of the milk quota in this industry: since we assume a shift in consumer preferences towards dairy products and since the milk quota prevents production from increasing, import of dairy products increases by 6-9 per cent per year. As a result the import share in the local market increases from 23 per cent in 2000 to 39 per cent in 2010.

Chart 21 Dairy products, per cent

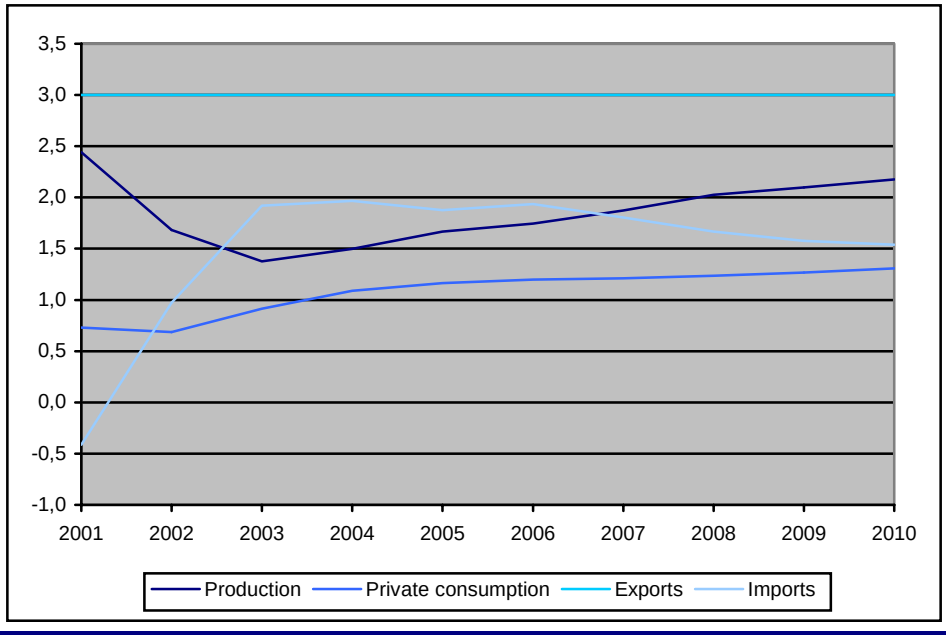


22 Starch, chocolate products, etc. (ranked no. 31)

This industry concentrates on the production of starch and grain mill products. Chocolates and other confectionary comprise only a small proportion of its overall output. Its sales are wide spread, with more than half being exports, and a fifth being sales to private consumers. Import penetration is quite high at over 40 per cent.

We are forecasting output growth for this industry of 1.9 per cent per annum. We expect the industry's output growth to be restrained by an adverse shift in consumer preferences (Table 3) such that consumption grows by only 1 per cent per year (Chart 22). Against this, though, we are assuming quite strong growth in exports of 3.0 per cent per year (Table 2).

Chart 22 Starch, chocolate products etc., per cent



23 Bread, grain mill and cakes (ranked no. 26)
This industry produces bakery products mainly for sale in large retail outlets such as supermarkets. Retail-level production at local cake shops etc. is accounted for in the production of *24 Bakery shops*. The industry's main customers are households (35 per cent of total sales), and foreign buyers (exports account for 45 per cent of total sales).

Export is expected to grow at 3.4 per cent per annum. However, being strongly oriented towards consumption makes prospects for growth in this industry highly depended on growth in consumption and changes in consumer preferences too. We assume that private consumption will grow at an average annual rate of 2.3 per cent (Table 1). However, the share of bread etc in the consumer's budget is assumed to fall as a result of an unfavourable shift in preferences (Table 3). These factors combine to give the industry a forecast growth rate of 2.0 per cent per year.

24 Bakery shops (ranked no. 44)
This industry produces bakery products in local cake shops etc. This industry produces exclusively for household and restaurant use. There are no exports, and no import competition.
Like the products produced by industry 23, bakery output is heavily constrained by adverse shifts in consumer tastes (Table 3). But unlike industry 23 there are no positive effect on production through good export prospects. Our forecast for output growth in this industry is therefore only 0.5 per cent per year.

25 Sugar factories and refineries (ranked no. 19)
Sugarbeets are refined into raw and refined sugar by this industry. The sugar is mainly sold for export and for use by other food manufacturing industries. There is relatively little direct consumption. Import penetration on local markets is around 25 per cent.

Prospects for growth in this industry depend very much on our forecasts for exports. Sugar is currently classed as a non-traditional export. Non-traditional exports are forecast to increase at the rate of 3.4 per cent per year. However, the forecast output growth rate for this industry is only 2.5 due to low growth prospects of domestic sales.

26 Beverage production (ranked no. 24)
Beverages, both alcoholic and non-alcoholic are produced by this industry. Households consume nearly half of production, while a quarter is exported. Import penetration is quite high at over 30 per cent.

Our forecast growth rate for this industry is 2.3 per cent per year in line with our forecast for aggregate consumption growth (Table 1).

27 Tobacco manufacture (ranked no. 29)
The main markets for this industry are abroad (exports comprise over half of total sales). Locally, a large proportion of the market is met from imports.

This industry is harmed from a shift in consumer preferences against its products. We are assuming that this trend will continue through the forecast period. On the other hand, export growth of 3.4 per cent per year on average ensures that production grows by 1.9 per cent on average.

28 Textiles, wearing apparel and leather (ranked no. 12)
This industry did poorly through the historical period, being decimated by imports. In response, it has become increasingly focussed on exports, allowing the local market to be supplied by imports. The intensity of these trends has been such that by 2000 import penetration is around 85 per cent, and the industry's export propensity is about 78 per cent.

Our forecasts take these developments into account. Its growth prospects now depend primarily on expected export growth. We have assumed that exports will grow at an average annual rate of 4.9 per cent (Table 2). This implies a growth rate in output of 3.2 per cent on average.

29 Manufactured wood and glass products (ranked no. 32)
This industry produces products sold directly to the construction and building materials industries, with exports also representing a large share of its sales. Nearly 50 per cent of the local market is sourced from imports.

Our forecast for output growth in this industry is 1.8 per cent per year. This industry owes its low output ranking in our forecasts to two factors. First, we are assuming that aggregate investment will grow at an average annual rate of only 1.3 per cent in the forecast period (Table 1). Second, we are assuming that domestic sales of wood and

glass products will be adversely affected by trends against the use of these products as intermediate inputs to production and as inputs to investment (Table 3).

30 Paper products and publishing (ranked no. 37)
The major industrial customer for this industry is *47 financial and property services*, which uses large amounts of paper for banking slips, advertising, etc. The publishing component of this industry is quite small, consisting mainly of the production of newsprint and paper for magazines.

We assume that this industry will be restrained from a shift in technology against the use of paper per unit of output in customer industries (Table 3). Thus growth prospects for paper production are subdued.

31 Oil refinery products (ranked no. 8)
Petroleum refineries produce products that are sold widely through the economy. The export propensity of these products is quite high at around 50 per cent overall. The industry also faces considerable import competition locally, with imports meeting about 45 per cent of local demand.

Our forecast growth rate for this industry is 3.7 per cent per annum. The main factor underlying this forecast is strong export growth. Exports of petroleum products are assumed to expand at an annual rate of 4.9 per cent (Table 2).

32 Basic chemicals (ranked no. 2)
Basic chemicals are one of the most trade-exposed industries in the economy. Exports account for over 60 per cent of total sales, almost exactly equal to the degree of import penetration on local market. The majority of imports are raw materials for further chemical manufacture.

Strong growth in exports underlies our forecast for strong growth in this industry. Another positive factor is our assumption that industries will become more intensive in their use of chemicals (which includes plastic products) (Table 3). Therefore, basic chemicals grow at 4.3 per cent per annum.

33 Fertiliser (ranked no. 14)
This is a small industry with obviously strong connections to agriculture. Exports are another important source of revenue, with over 40 per cent of production exported.

Import penetration is very high. Most imports are of raw material used to produce final fertiliser products.

Growth in this industry is slightly above the growth rate of cereal reflecting our assumption of relatively strong export growth (Table 2).

34 Agricultural chemicals nec (ranked no. 4)
This industry produces a range of miscellaneous agricultural chemicals which are primarily used in the production of fungicide, insecticides and herbicide. Import penetration on the local market is high.

Despite slow growth in local agricultural demand, this industry has very good growth prospects. This reflects our assumption of strong growth in exports (Table 2).

35 Non-metallic building materials (ranked no. 35)
The main output of this industry is cement, concrete products, bricks and tiles. Thus it has strong connections to investment (construction) and maintenance activities. Its major industrial customer is *42 Construction*. Many expensive materials, such as floor and bathroom tiles are imported.

This industry's low output ranking stems from a combination of weak overall investment growth (Table 1) and our technology assumptions. As shown in Table 3, we assume that inputs of the sector's product per unit of output in customer industries will decline by 0.5 per cent per annum. The industry's main customer is the construction industry, which has a forecast growth rate of 1.6 per cent per year.

36 Metal products (ranked no. 5)
This industry produces iron and steel, non-ferrous metals such as aluminium, and a range of metallic products including largely for building use. The industry has a high export propensity (49 per cent), and faces strong import competition. Import penetration on the local market is over 70 per cent.

Our forecast for output growth in this industry is 4.1 per cent per year. This reflects the strong export potential for the industry (Table 2).

37 Machinery and non-transport equipment (ranked no. 1)
This industry provides mainly service and spare parts for construction and farming equipment. Imports comprise a large share of the domestic market. Most of these im-

ports are of operational equipment and machines such as tractors and harvesters. Exports comprise an important source of revenue (almost 60 per cent of all sales).

This industry has relatively good growth prospects in the forecast period. It benefits from strong export growth (Table 2), and from a favourable shift in industry technologies (Table 3).

38 Transport equipment (ranked no. 3)

Transport equipment consists of motor vehicles, railway rolling stock and ships. Most of these items are imported. The domestic industry mainly provides service and spare parts for maintaining the equipment. Imports comprise nearly 70 per cent of the local market, while exports account for around 50 per cent of production from the domestic industry.

The key to our forecast for relatively strong growth in this industry is exports, which are assumed to increase by nearly five per cent per year (Table 2). Growth in domestic sales for local manufacturers will be somewhat slower. The domestic market is forecast to expand by about 4 per cent per year, due largely to changes in industry technologies that favour transport equipment (Table 2). However, we are forecasting that most of these additional sales will be of imported equipment.

39 Electricity (ranked no. 9)

Electricity is largely non-traded, and is used widely throughout the economy. Industries account for nearly 60 per cent of total sales, and private consumption accounts for most of the remaining production.

We are forecasting strong output growth in this sector. This is explained by two factors. First, we assume a continuation of a trend from the mid-1980s towards greater use of the products of this sector per unit of output throughout Danish industry (Table 3). Second, we are projecting rapid microeconomic reform for the sector (Table 3). This makes its products relatively cheap and will encourage substitution towards them by consumers.

40 Gas (ranked no. 30)

The gas industry provides gas for distribution either directly (via pipes) or indirectly (via bottled gas). Gas is used mainly for heating and cooking, hence the industry's production is sold widely.

Our assumption that the extraction of oil and gas will fall limits scope for additional production of retail gas. Hence, even though we expect favourable shift in preferences, private consumption decreases. But since gas is treated as a non-traditional export commodity we forecast an export growth rate of 3.4 per cent per annum on average. Therefore, production is based to a larger and larger extent on imported raw inputs such that it grows at 1.9 per cent per year on average.

41 Steam and hot water (ranked no. 15)
Like gas, steam and hot water are sold widely through the economy. The main use is for heating of residential homes.

The dynamics of the steam and hot water production matches those of private consumption. Our forecast for average annual growth of output in this industry is 2.7 per cent on average, somewhat above aggregate consumption growth, which is forecast to grow at the rate of 2.3 per cent per year. The reason for this is a high expenditure elasticity on steam and hot water.

42 Construction (ranked no. 33)
Construction services are sold primarily to investment. Sales to industries for use in current production consist primarily of maintenance and repair services.

We are forecasting growth in construction output of 1.6 per cent per year. This is in line with our macro forecast for aggregate investment (Table 1).

43 Motor vehicle services (ranked no. 13)
This industry provides service and maintenance facilities for motor vehicles. These include the operation of petrol stations and crash repairers. The majority sales are to households. Other major customers include the vehicle-intensive *45 Wholesale trade* and *46 Retail trade* industries.

We are forecasting relatively robust growth for this industry, with most of the additional production going to households. As shown in Table 3, we have assumed in our forecasts a shift in consumer preferences towards the use of vehicle service facilities in line with strong growth in vehicle purchases.

44 Wholesale trade (ranked no. 27)
This large industry provides wholesale trade services. Though not directly exposed to trade, it is indirectly exposed through the provision of trade services to exporters and importers.

Wholesale trade services are used throughout the economy, but particularly intensively in facilitating international trade. This suggests first an increasing rate of growth through the period, and second an average growth rate a little above that of real GDP. Note, that our forecast for output growth would have been higher were it not for the restraints imposed by adverse technological changes leading to a more economic use of wholesale trade services (Table 3).

45 Retail trade (ranked no. 43)
Like the wholesale industry, this industry provides margin services. These services are provided to facilitate retail transactions.

In our forecasts, private consumption grows at a slightly increasing rate (Figure 2). The dynamics of this industry's output follow this trend. However, the average annual rate of growth of aggregate consumption is 2.3 per cent while the average growth rate of this industry's output is only 0.7 per cent. This is explained by the deleterious effects of a shift in consumer preferences against the use of retail trade (Table 3).

46 Freight transport (ranked no. 23)
The smallest of the three margins industries, this industry provides freight services. These services cover all four major modes of freight transport: road, rail, water and air.

Because transport services are used intensively in facilitating international trade, production growth in this industry will tend to follow the upward trend in the growth of international trade. As can be seen from Table 1, we are forecasting that international trade will grow by almost four per cent per annum on average. Our forecast for freight output, though, is only 2.3 per cent. We expect the industry's output growth to be restrained by technological changes economising on the use of transport inputs (Table 3).

47 Financial and property services (ranked no. 10)
This is the largest industry recognised in the 1995 AAGE database. It covers a large range of activities including the provision of banking services, non-bank financial

services, insurance services, and business services such as real estate, accounting and legal services.

As explained above, we have assumed in our forecasts shifts in consumer preferences and in industry technologies towards the use of financial and property services. This gives this industry above-GDP growth prospects.

48 Transport and communication services (ranked no. 6)
This industry is dominated by the provision of communication services, both telecommunication and postal. Export sales of communication services consist mainly of charges imposed by Danish telephone companies and Danish postal companies on foreign communications companies for distributing incoming phone calls and mail within Denmark.

Communication services are sold throughout the economy. In the absence of communications-using technological changes, our output forecast for communications would be close to our GDP forecast (Table 1). As shown in Table 3, though, we assume communications-using technological change of 2.5 per cent per year by industries and a communications-favouring taste change of 1.5 per cent per year by households. This results in an output forecast for communication services well in advance of our GDP forecast.

49 Public services (ranked no. 42)
This industry provides government and other public services. It covers the provision of public administration, welfare and community services, including health care and police services. It sells primarily to the government.

We are forecasting annual growth of public consumption at 1 per cent in 2001-5 falling to 0.5 per cent in 2006-10.

50 Dwellings (ranked no. 25)
The output of the dwellings industry is the services of the nation's housing stock. These services are produced with only one input, housing capital.
We are forecasting output growth in dwellings of 2.1 per cent per year. This reflects our assumption that dwelling investment grows at the rate of 2.6 per cent on average (as forecast by the Danish Economic Council) starting from a relatively low level.

7. Conclusions

In this paper, we have reviewed the dynamic relationships as well as the dynamic data used in the Dynamic-AAGE model. We have described the method for producing detailed forecasts of the industrial structure of the economy using the model. We have outlined the inputs from specialist macroeconomic forecasters and from own analyses as well as the assumptions on changes in preferences of households and technologies of industries. Finally, we have described the structural forecasts from 2000 to 2010 industry-by-industry. In this section we focus on two issues: first what is the role of the structural forecasts, and second how may the forecasts be improved.

The structural forecasts may be seen as a supplement to traditional macroeconomic forecasts: they provide a microeconomic picture that is consistent with the macroeconomic scenario. We think that structural forecasts may be of interest to a wide range of groups, including

- Government authorities and private organisations concerned with the prospects for particular industries;
- employer and employee groups concerned with reaching agreements compatible with satisfactory profits and employment opportunities in their industries;
- educational and training authorities concerned with anticipating changes in the occupational and industrial allocation of the labour force;
- governments concerned with the development of public infrastructure;
- mulit-industry businesses concerned with the allocation of their resources; and
- financial institutions concerned with lending to businesses and investment advice.

Moreover, structural forecasts form the basis for any “what if” question: how different would the economy look year-by-year if a policy change, or some other disturbances, occur in a particular year.

Our structural forecasts may be improved in two directions. First the quality of the inputs may be improved, and second the quality of the modelling may be improved. Improving the quality of inputs includes

- more recent macroeconomic forecasts that take into account the development of the world economy in 2001;

- scenarios on changes in preferences of households and production technologies based upon trends in Denmark. This requires that we calculate such trends for a relatively long historical period using Dynamic-AAGE;
- more industry-specific expertise. One way to reach such expert knowledge is to form expert groups that can provide industry-specific inputs and judge the quality of the industry-specific output of the forecasting.

Improving the quality of the modelling may relate to

- households' preferences;
- inclusion of different types of labour;
- updating of the external debt;
- industry-specific parameters such as export elasticities.

These improvements are topics for future research. Hopefully, we are able to address some of the issues as part of ongoing projects while other issues are so comprehensive that they form large research projects in their own right.

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Appendix A

Commodities and Industries in the 1995 AAGE database

		Industries			Commodities
*	1	Cereal	#	1	Cereal
*	2	Oil seeds		2	Oil seeds
*	3	Potatoes		3	Potatoes
*	4	Sugerbeets		4	Sugerbeets
*	5	Roughage		5	Roughage
	6	Meat cattle and milk producers		6	Meat cattle
	7	Pigs		7	Milk
	8	Poultry		8	Pigs
	9	Hunting and fur farming, etc.		9	Poultry
*	10	Horticulture	#	10	Hunting and fur farming, etc.
	11	Agricultural services, etc.	#	11	Horticulture
	12	Forestry		12	Agricultural services, etc.
	13	Fishing		13	Forestry
	14	Extraction of coal, oil and gas	#	14	Fishing
	15	Cattle-meat products	#	15	Extraction of coal, oil and gas
	16	Pig-meat products	#	16	Cattle-meat products
	17	Poultry-meat products	#	17	Pig-meat products
	18	Fish products		18	Poultry-meat products
	19	Processed fruit and vegetables	#	19	Fish products
	20	Processed oils and fats		20	Processed fruit and vegetables
	21	Dairy products	#	21	Processed oils and fats
	22	Starch, chocolate products, etc.	#	22	Dairy products
	23	Bread, grain mill and cakes	#	23	Starch, chocolate products, etc.
	24	Bakery shops		24	Bread, grain mill and cakes
	25	Sugar factories and refineries		25	Bakery shops
	26	Beverage production		26	Sugar factories and refineries
	27	Tobacco manufacture		27	Beverage production
	28	Textile, wearing apparel and leather		28	Tobacco manufacture
	29	Manufactured wood and glass prod-ucts	#	29	Textile, wearing apparel and leather
	30	Paper products and publishing		30	Manufactured wood and glass products
	31	Oil refinery products		31	Paper products and publishing
	32	Basic chemicals	#	32	Oil refinery products
	33	Fertiliser	#	33	Basic chemicals
	34	Agricultural chemicals nec		34	Fertiliser
	35	Non-metallic building material	#	35	Agricultural chemicals nec
	36	Metal products		36	Non-metallic building material
	37	Machinery and non-transport equip-ment	#	37	Metal products
	38	Transport equipment	#	38	Machinery and non-transport equipment
	39	Electricity	#	39	Transport equipment
	40	Gas		40	Electricity
	41	Steam and hot water		41	Gas
	42	Construction		42	Steam and hot water
	43	Motor vehicles service		43	Construction
	44	Wholesale trade		44	Motor vehicles service
	45	Retail trade		45	Wholesale trade
	46	Freight transport		46	Retail trade
	47	Financial and property services		47	Freight transport
	48	Transport and communication ser vices		48	Financial and property services

to be continued

Commodities and Industries in the 1995 AAGE database (continued)

Industries		Commodities	
49	Public services	49	Transport and communication services
50	Dwelling ownership	50	Public services
		51	Dwelling ownership
		52	Coal imports
		53	Manure
		54	Fungicide
		55	Insecticides
		56	Herbicide

*Sectors using land for production. # Commodities classed as traditional export commodities (producers of traditional export commodities face individual downward-sloping world-demand schedules for exports).

Appendix B

Data on capital accumulation

	Industry	Capital stock at the beginning of 1995	Depreciation rate
		Billion DKK	Per cent
1	Cereal	45.571	3.1
2	Oil seeds	2.153	3.1
3	Potatoes	5.368	3.1
4	Sugerbeets	5.360	3.1
5	Roughage	12.488	3.1
6	Meat cattle and milk producers	47.112	3.1
7	Pigs	68.664	3.1
8	Poultry	9.215	3.1
9	Hunting and fur farming, etc.	10.312	3.1
10	Horticulture	7.042	3.2
11	Agricultural services, etc.	14.172	3.1
12	Forestry	5.572	2.7
13	Fishing	16.478	5.4
14	Extraction of coal, oil and gas	54.427	4.8
15	Cattle-meat products	2.940	4.6
16	Pig-meat products	18.021	4.6
17	Poultry-meat products	909	4.6
18	Fish products	5.957	4.6
19	Processed fruit and vegetables	3.140	4.6
20	Processed oils and fats	1.573	4.6
21	Dairy products	13.162	4.6
22	Starch, chocolate products, etc.	12.960	4.6
23	Bread, grain mill and cakes	5.217	4.6
24	Bakery shops	5.005	4.6
25	Sugar factories and refineries	4.381	4.6
26	Beverage production	12.802	4.6
27	Tobacco manufacture	4.697	4.6
28	Textile, wearing apparel and leather	18.093	4.5
29	Manufactured wood and glass products	10.560	3.6
30	Paper products and publishing	9.136	4.8
31	Oil refinery products	6.731	3.9
32	Basic chemicals	64.264	4.4
33	Fertiliser	390	4.4
34	Agricultural chemicals nec	369	4.4
35	Non-metallic building material	36.824	4.4
36	Metal products	13.511	4.4
37	Machinery & non-transport equipment	120.004	4.4
38	Transport equipment	28.457	4.4
39	Electricity	168.121	2.1
40	Gas	87.037	2.1
41	Steam and hot water	69.177	2.1
42	Construction	57.912	6.4
43	Motor vehicles service	5.069	3.9
44	Wholesale trade	148.973	3.9
45	Retail trade	64.569	4.3
46	Freight transport	66.566	5.8
47	Financial and property services	2.076.162	2.1
48	Transport and communication services	298.456	5.8
49	Public services	513.992	2.1
50	Dwelling ownership	135.325	2.1

Appendix C

Data on financial asset accumulation

	Variable	1995
		Billion DKK
1.	Net external debt at the beginning of the year	259.000
2.	Interest payments to foreigners	122.255
3.	Dividend payments to foreigners	12.016
4.	Transfer payments to foreigners	39.257
5.	Interest payments from foreigners	99.388
6.	Dividend payments from foreigners	9.068
7.	Transfer payments from foreigners	30.547
8.	Net government debt at the beginning of the year	681.300
9.	Income tax revenue	339.313
10.	Revenue from indirect taxes	139.392
11.	Revenue from taxes on capital and land	-3.527
12.	Public consumption	260.299
13.	Public investment	15.300
14.	Returns to public investment	36.363
16.	Interest payments	31.740
17.	Unemployment benefits	29.648
18.	Other transfer payments to households	198.826

Appendix D

Sales Shares for Commodities in the 2000 AAGE database

	Commodities	Share in total sales of sales to: Industries	Invest.	Consum.	Exports	Gov.	Stocks	Margins	Total	Import share in local market
1	Cereal	72.2	0.0	3.1	20.2	0.0	4.5	0.0	100.0	11.6
2	Oil seeds	44.5	0.0	2.0	52.9	0.0	0.6	0.0	100.0	62.8
3	Potatoes	56.2	0.0	16.8	25.1	0.0	1.9	0.0	100.0	36.4
4	Sugerbeets	99.7	0.0	0.0	0.0	0.0	0.3	0.0	100.0	0.3
5	Roughage	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
6	Meat cattle	86.3	2.4	3.1	8.5	0.0	-0.4	0.0	100.0	13.1
7	Milk	97.7	0.0	2.0	0.0	0.0	0.3	0.0	100.0	0.2
8	Pigs	98.1	0.0	0.0	2.2	0.0	-0.3	0.0	100.0	0.0
9	Poultry	74.5	0.0	18.1	7.8	0.0	-0.4	0.0	100.0	7.8
10	Hunting and fur farming, etc.	21.3	0.0	0.0	65.1	0.0	13.6	0.0	100.0	32.0
11	Horticulture	13.8	0.0	31.0	54.6	0.0	0.5	0.0	100.0	55.3
12	Agricultural services, etc.	83.3	0.0	1.5	0.0	15.1	0.0	0.0	100.0	0.0
13	Forestry	54.1	0.0	10.7	33.7	0.0	1.5	0.0	100.0	20.7
14	Fishing	24.1	0.0	0.8	73.2	0.0	1.9	0.0	100.0	64.1
15	Extraction of coal, oil and gas	35.0	0.5	0.0	64.0	0.0	0.4	0.0	100.0	64.9
16	Cattle-meat products	15.7	0.0	24.9	60.7	0.0	-1.4	0.0	100.0	43.3
17	Pig-meat products	21.1	0.0	15.9	64.0	0.0	-1.0	0.0	100.0	17.0
18	Poultry-meat products	7.5	0.0	7.8	85.2	0.0	-0.5	0.0	100.0	60.6
19	Fish products	25.1	0.0	2.1	73.4	0.0	-0.7	0.0	100.0	53.2
20	Processed fruit and vegetables	32.3	0.0	40.3	28.2	0.0	-0.8	0.0	100.0	38.1
21	Processed oils and fats	51.0	0.1	5.8	41.7	0.0	1.4	0.0	100.0	67.7
22	Dairy products	18.6	0.1	24.9	55.6	0.0	0.9	0.0	100.0	23.0
23	Starch, chocolate products, etc.	27.4	0.1	19.0	53.4	0.0	0.1	0.0	100.0	46.0
24	Bread, grain mill and cakes	18.6	0.6	34.3	46.6	0.0	-0.1	0.0	100.0	20.5
25	Bakery shops	21.9	0.3	77.9	0.0	0.0	0.0	0.0	100.0	0.0
26	Sugar factories and refineries	46.7	0.1	4.0	45.0	0.0	4.4	0.0	100.0	25.5
27	Beverage production	23.4	0.2	43.7	31.0	0.0	1.7	0.0	100.0	32.0
28	Tobacco manufacture	3.0	0.0	35.0	63.2	0.0	-1.2	0.0	100.0	36.9
29	Textile, wearing apparel and leather	9.1	2.8	8.8	77.5	0.1	1.8	0.0	100.0	85.3
30	Manufactured wood and glass products	48.4	3.6	2.3	43.7	0.0	2.0	0.0	100.0	50.6

To be continued

Sales Shares for Commodities in the 2000 AAGE database (continued)

	Commodities	Share in total sales of sales to: Industries	Invest.	Consum.	Exports	Gov.	Stocks	Margins	Total	Import share in local market
31	Paper products and publishing	67.5	1.1	13.3	17.6	0.1	0.4	0.0	100.0	28.2
32	Oil refinery products	30.6	0.1	22.3	51.5	0.0	-4.5	0.0	100.0	46.2
33	Basic chemicals	27.4	1.3	2.2	67.9	0.7	0.6	0.0	100.0	67.0
34	Fertiliser	54.4	0.3	3.0	44.8	0.0	-2.4	0.0	100.0	65.0
35	Agricultural chemicals nec	23.8	0.0	0.8	77.9	0.0	-2.6	0.0	100.0	61.8
36	Non-metallic building material	72.8	1.7	1.3	23.5	0.0	0.8	0.0	100.0	16.6
37	Metal products	47.7	1.7	0.4	48.8	0.0	1.4	0.0	100.0	71.2
38	Machinery and non-transport equipment	22.9	13.9	2.9	59.0	0.2	1.2	0.0	100.0	60.0
39	Transport equipment	16.7	29.0	1.7	52.7	0.1	-0.2	0.0	100.0	68.2
40	Electricity	58.4	0.5	36.0	5.1	0.0	0.0	0.0	100.0	2.0
41	Gas	53.0	0.0	30.3	16.5	0.0	0.2	0.0	100.0	0.8
42	Steam and hot water	32.9	0.0	67.1	0.0	0.0	0.0	0.0	100.0	0.0
43	Construction	23.6	68.4	3.4	0.1	4.5	0.0	0.0	100.0	0.0
44	Motor vehicles service	42.2	0.3	57.5	0.0	0.0	0.0	0.0	100.0	0.0
45	Wholesale trade	0.6	0.0	4.4	0.2	0.0	0.0	94.9	100.0	2.9
46	Retail trade	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
47	Freight transport	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
48	Financial and property services	52.6	10.0	24.4	2.6	2.1	8.3	0.0	100.0	1.6
49	Transport and communication services	46.7	0.1	15.1	37.6	0.5	0.0	0.0	100.0	4.3
50	Public services	6.8	0.3	8.6	0.4	83.9	0.0	0.0	100.0	0.0
51	Dwelling ownership	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0
52	Coal imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
53	Manure	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
54	Fungicide	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	41.2
55	Insecticides	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	39.9
56	Herbicide	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	80.0

Appendix E

Cost Shares for Industries in the 2000 AAGE database

	Industries	Share in total costs of: Intermediates	Labour	Capital	Land	Other	Total
1	Cereal	44.3	14.8	22.7	28.4	-10.1	100.0
2	Oil seeds	69.3	11.6	12.6	15.1	-8.4	100.0
3	Potatoes	39.3	10.6	45.5	5.3	-0.7	100.0
4	Sugerbeets	51.9	15.2	26.1	7.5	-0.7	100.0
5	Roughage	67.4	7.6	10.1	15.6	-0.7	100.0
6	Meat cattle and milk producers	64.0	20.5	5.1	8.8	1.7	100.0
7	Pigs	72.9	8.1	15.0	4.8	-0.8	100.0
8	Poultry	53.4	10.2	22.8	14.3	-0.7	100.0
9	Hunting and fur farming, etc.	34.5	5.6	58.5	2.2	-0.8	100.0
10	Horticulture	37.2	42.1	22.1	1.2	-2.6	100.0
11	Agricultural services, etc.	45.9	31.4	22.6	0.0	0.2	100.0
12	Forestry	56.8	24.9	15.8	0.0	2.6	100.0
13	Fishing	52.3	24.6	25.3	0.0	-2.2	100.0
14	Extraction of coal, oil and gas	13.8	5.3	77.9	0.0	3.0	100.0
15	Cattle-meat products	87.8	19.0	0.2	0.0	-7.0	100.0
16	Pig-meat products	79.8	14.2	6.1	0.0	-0.1	100.0
17	Poultry-meat products	79.6	18.0	2.5	0.0	-0.1	100.0
18	Fish products	81.0	14.0	5.1	0.0	-0.1	100.0
19	Processed fruit and vegetables	75.3	15.6	9.1	0.0	0.0	100.0
20	Processed oils and fats	84.9	11.0	3.9	0.0	0.1	100.0
21	Dairy products	85.5	11.3	4.1	0.0	-1.0	100.0
22	Starch, chocolate products, etc.	69.5	19.1	11.5	0.0	0.0	100.0
23	Bread, grain mill and cakes	59.2	25.3	15.5	0.0	-0.1	100.0
24	Bakery shops	45.1	34.7	20.5	0.0	-0.3	100.0
25	Sugar factories and refineries	56.9	15.7	32.4	0.0	-4.9	100.0
26	Beverage production	59.3	22.0	18.5	0.0	0.3	100.0
27	Tobacco manufacture	55.8	11.3	32.8	0.0	0.1	100.0
28	Textile, wearing apparel and leather	60.7	26.3	13.1	0.0	-0.2	100.0
29	Manufactured wood and glass products	55.5	33.0	11.7	0.0	-0.2	100.0
30	Paper products and publishing	54.2	39.6	6.3	0.0	-0.1	100.0
31	Oil refinery products	96.4	4.1	0.2	0.0	-0.6	100.0
32	Basic chemicals	54.5	26.7	18.9	0.0	-0.1	100.0
33	Fertiliser	77.7	17.0	5.8	0.0	-0.5	100.0
34	Agricultural chemicals nec	58.0	35.8	7.0	0.0	-0.8	100.0
35	Non-metallic building material	50.5	33.1	16.4	0.0	0.0	100.0
36	Metal products	62.8	19.0	18.5	0.0	-0.3	100.0
37	Machinery and non-transport equipment	54.8	31.7	13.6	0.0	-0.2	100.0
38	Transport equipment	61.3	31.4	9.0	0.0	-1.7	100.0
39	Electricity	32.9	19.3	47.4	0.0	0.3	100.0
40	Gas	41.3	7.7	51.2	0.0	-0.1	100.0
41	Steam and hot water	32.8	7.5	59.5	0.0	0.2	100.0
42	Construction	58.4	32.9	8.8	0.0	-0.1	100.0
43	Motor vehicles service	56.7	35.0	9.0	0.0	-0.7	100.0
44	Wholesale trade	37.1	39.9	22.8	0.0	0.1	100.0
45	Retail trade	32.7	41.1	26.3	0.0	-0.2	100.0
46	Freight transport	43.5	31.5	24.9	0.0	0.0	100.0
47	Financial and property services	36.9	32.2	30.5	0.0	0.4	100.0
48	Transport and communication services	39.5	32.5	29.4	0.0	-1.3	100.0
49	Public services	22.9	64.8	11.8	0.0	0.5	100.0
50	Dwelling ownership	11.7	47.1	40.5	0.0	0.7	100.0

Appendix F

Chart 23. Bread, grain mill and cakes, per cent

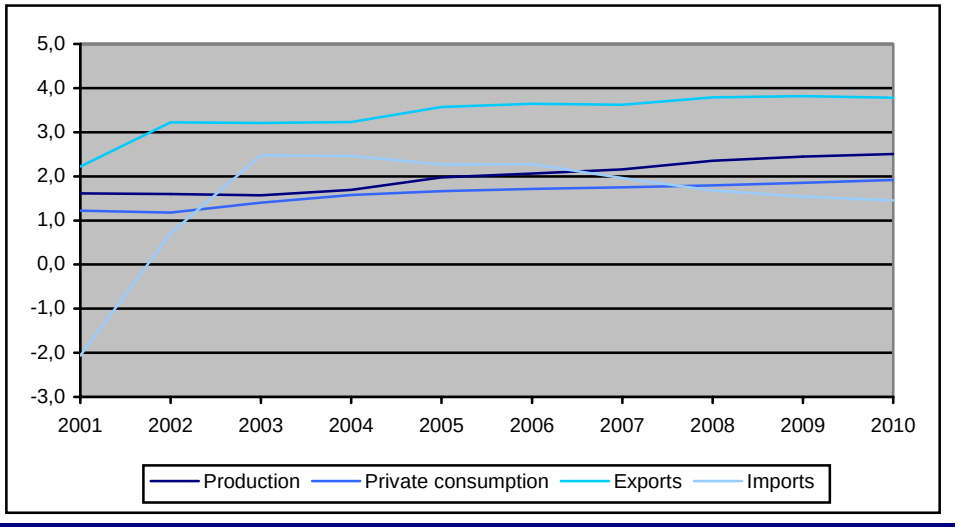

Chart 24. Bakery shops, per cent

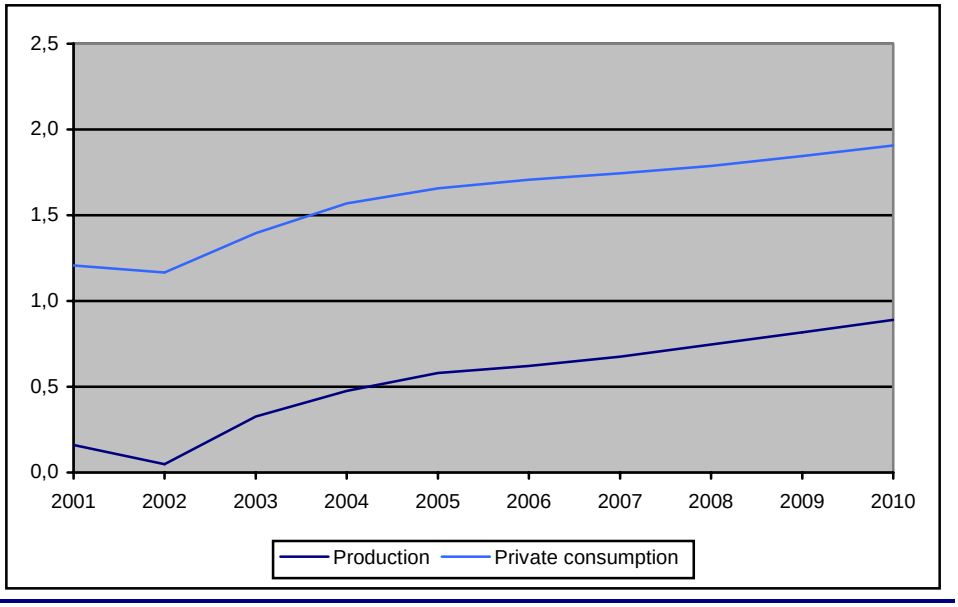

Chart 25. Sugar factories and refineries, per cent

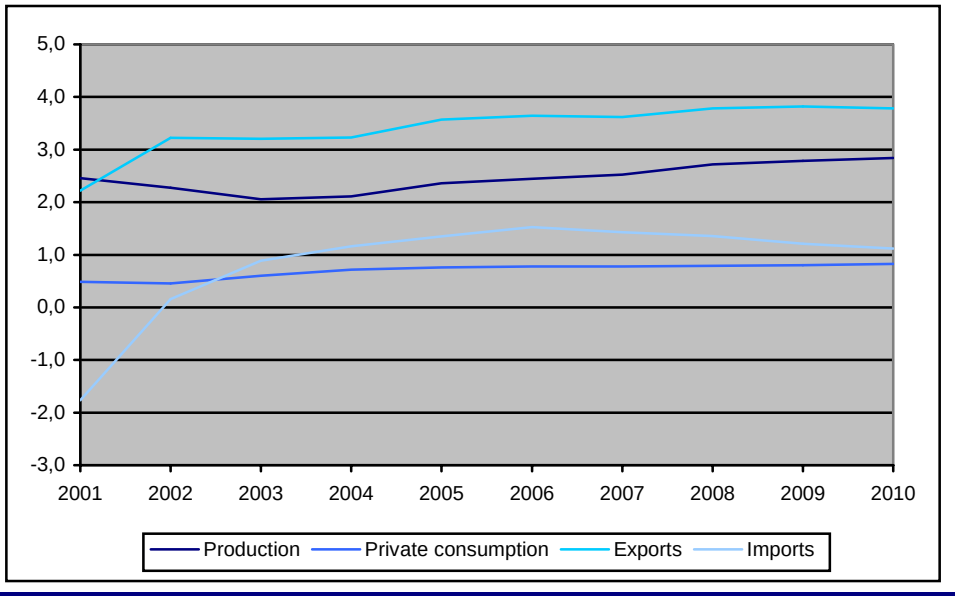

Chart 26. Beverage production, per cent

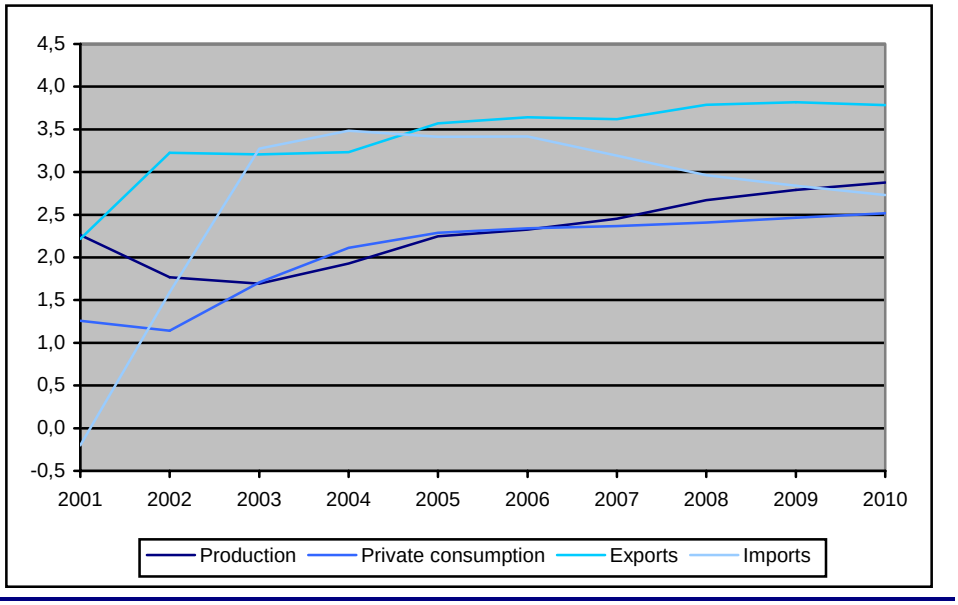

Chart 27. Tobacco manufacture, per cent

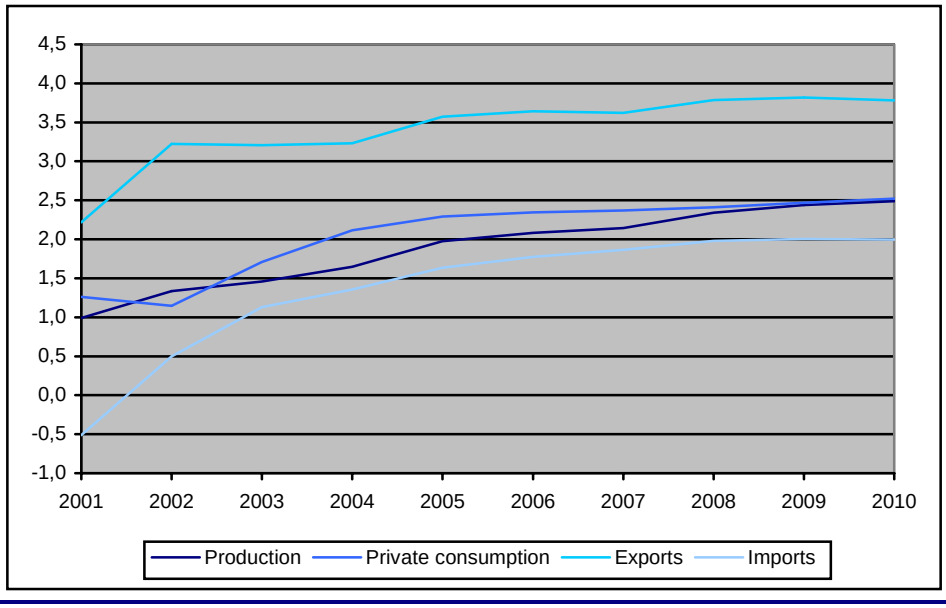

Chart 28. Textile, wearing apparel and leather, per cent

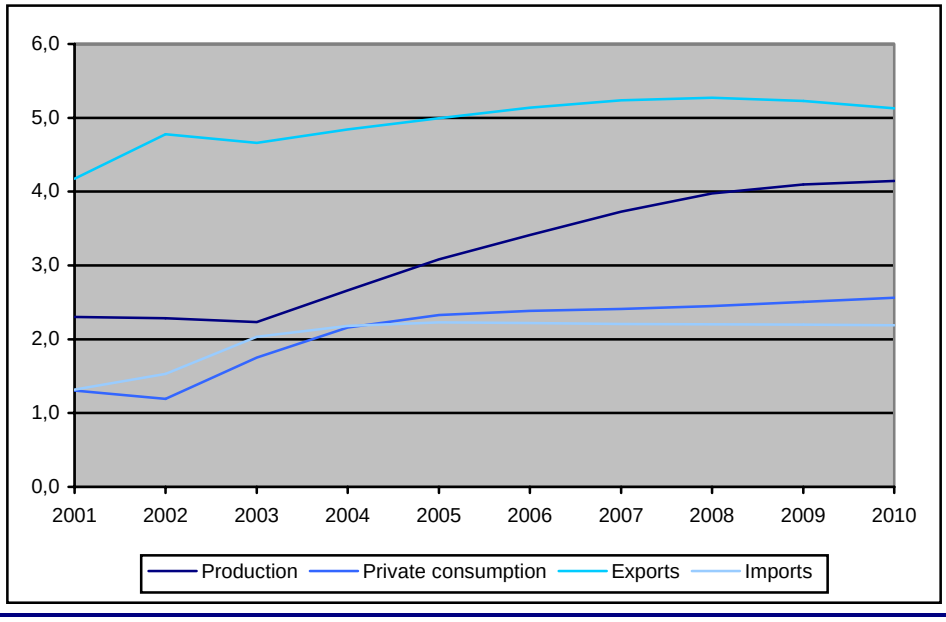

Chart 29. Manufactured wood and glass products, per cent

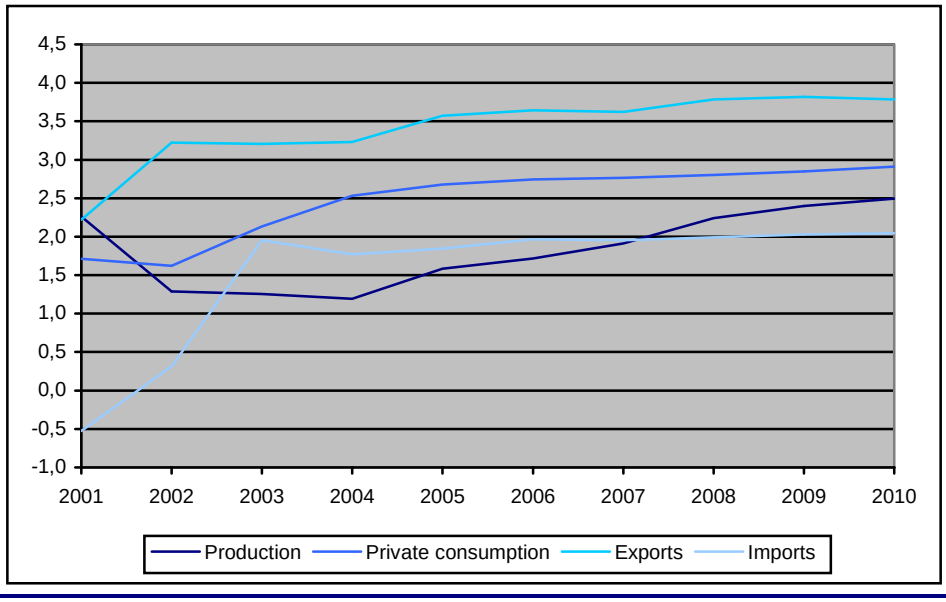

Chart 30. Paper products and publishing, per cent

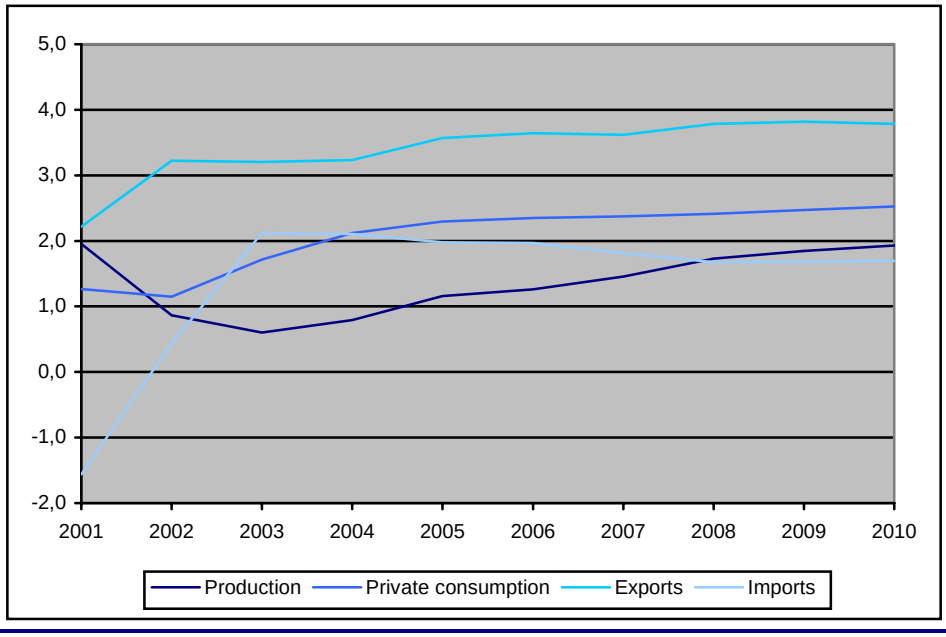

Chart 31. Oil refinery products, per cent

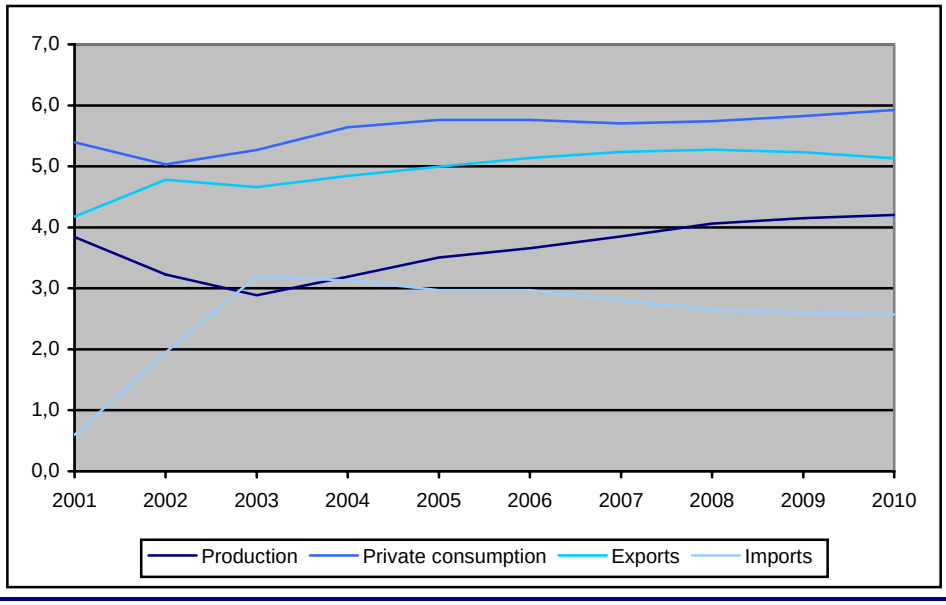

Chart 32. Basic chemicals, per cent

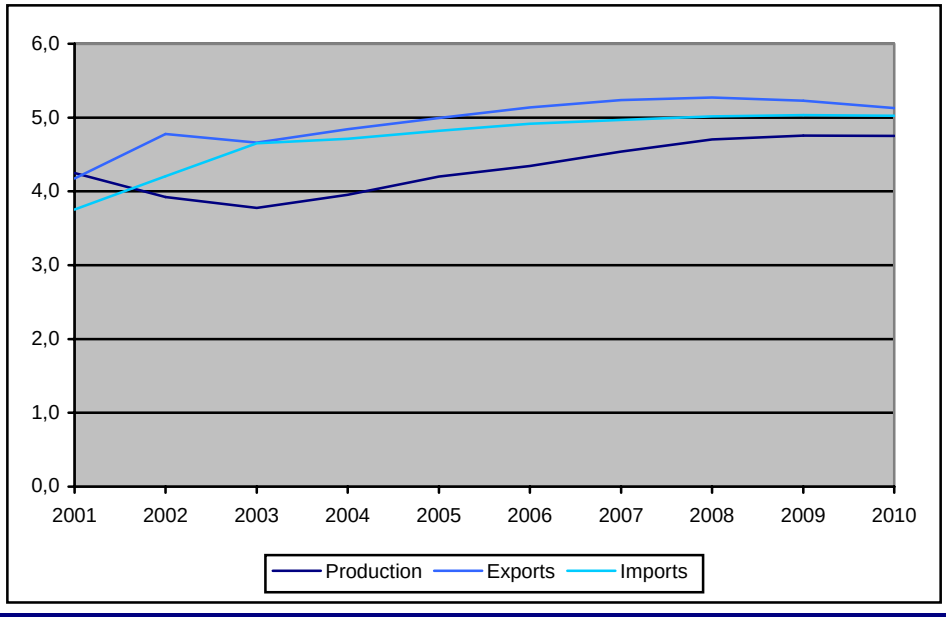

Chart 33. Fertiliser, per cent

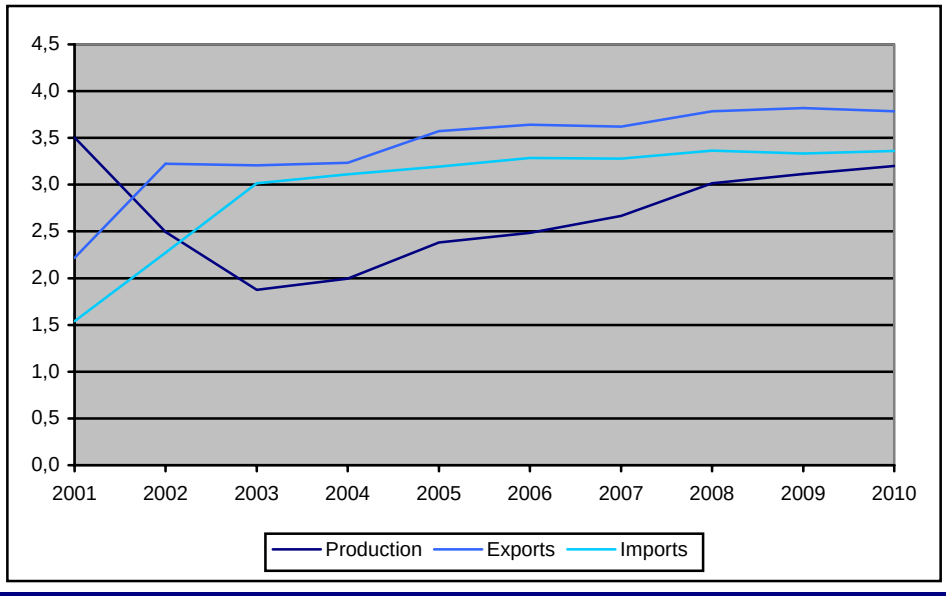

Chart 34. Agricultural chemicals nec, per cent

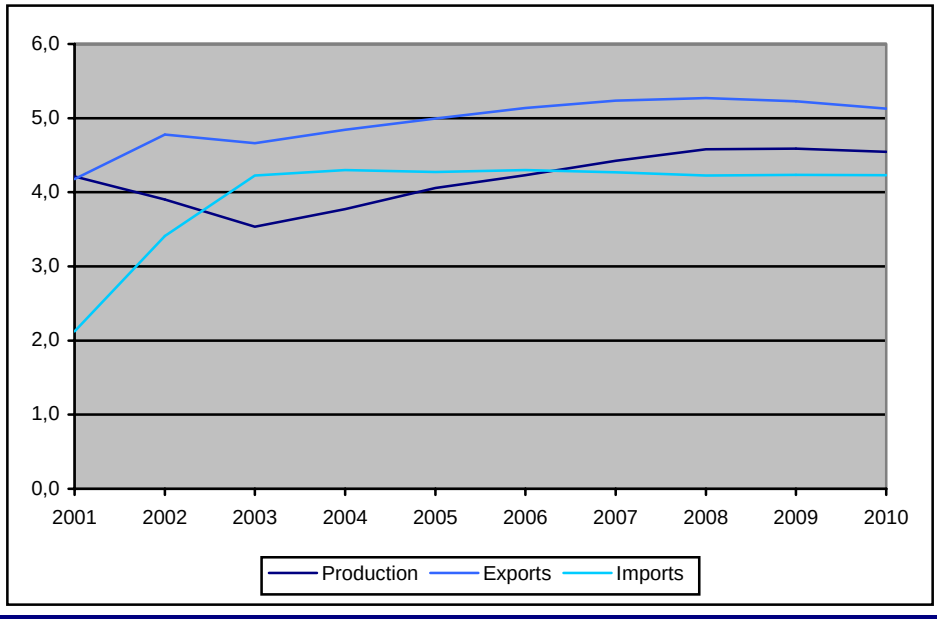

Chart 35.. Non-metallic builbing materials, per cent

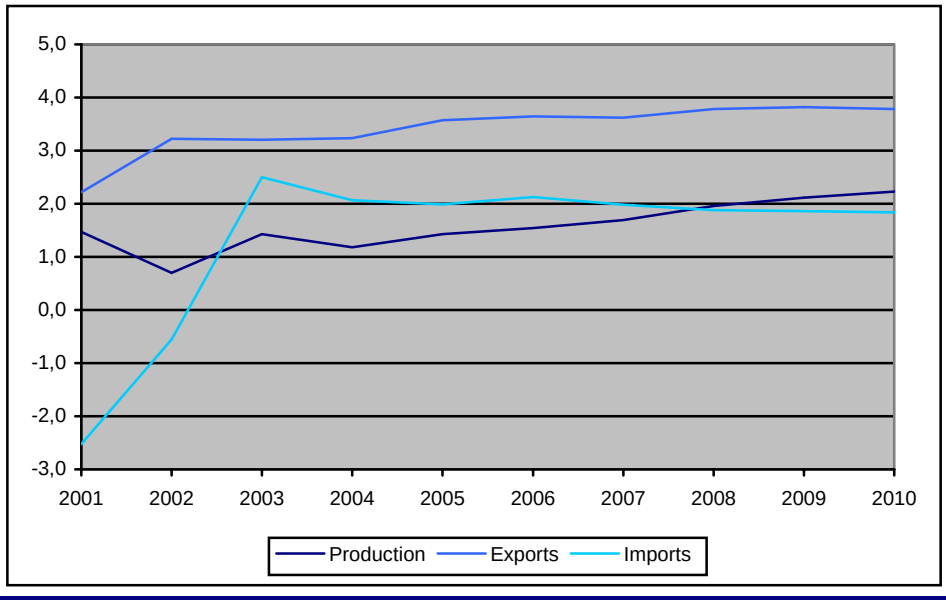

Chart 36.. Metal products, per cent

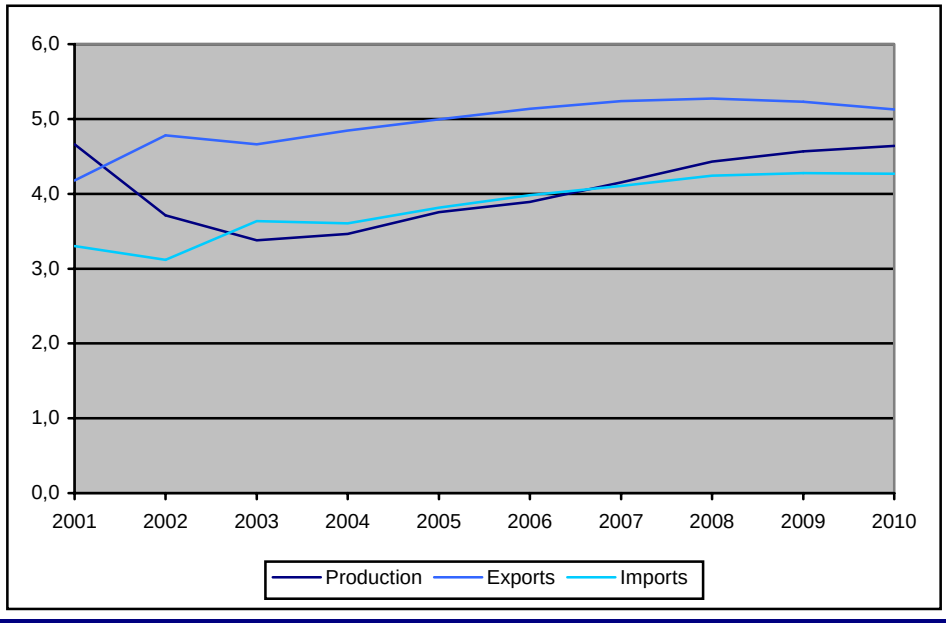

Chart 37. Machinery and non-transport equipment, per cent

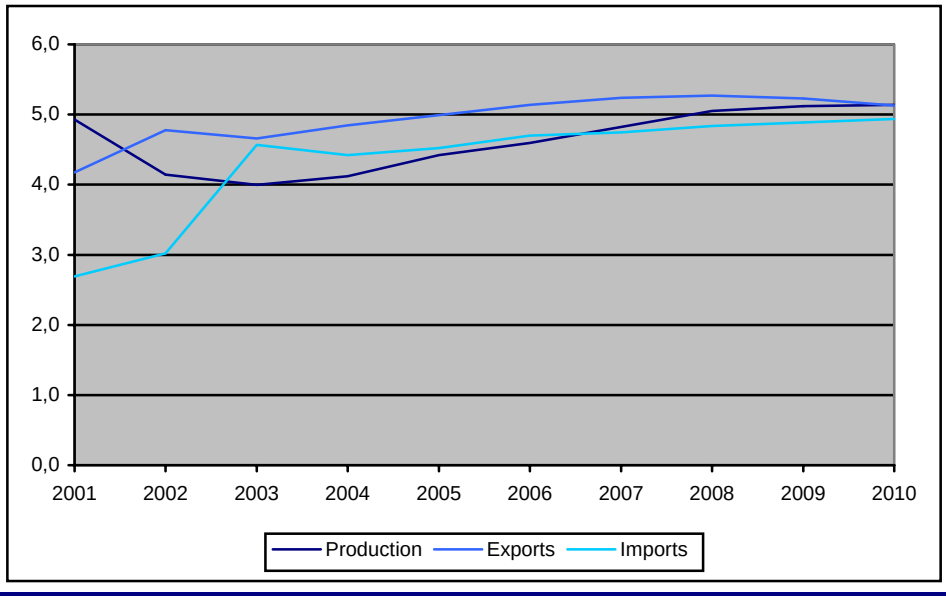

Chart 38. Transport equipment, per cent

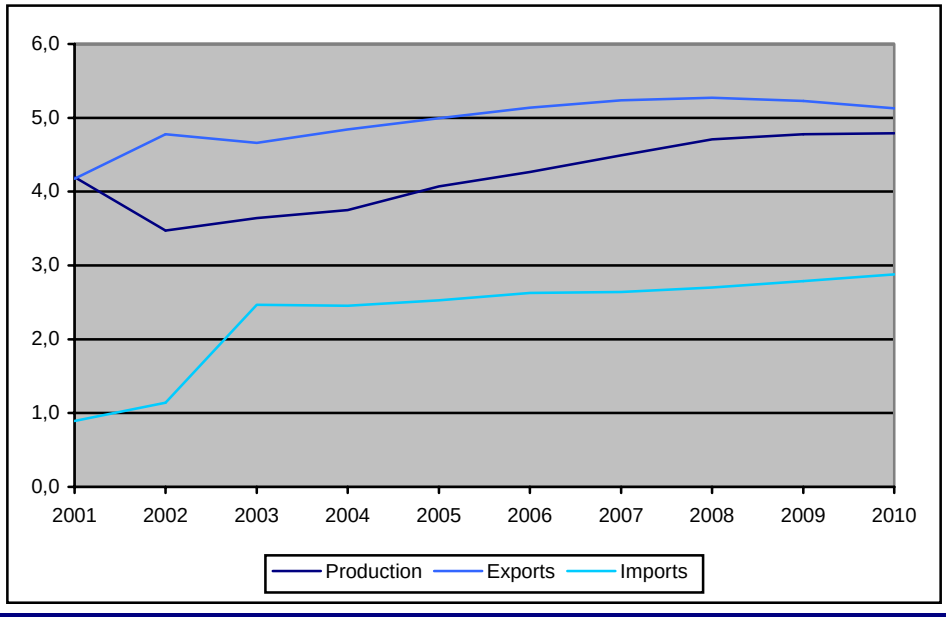

Chart 39. Electricity, per cent

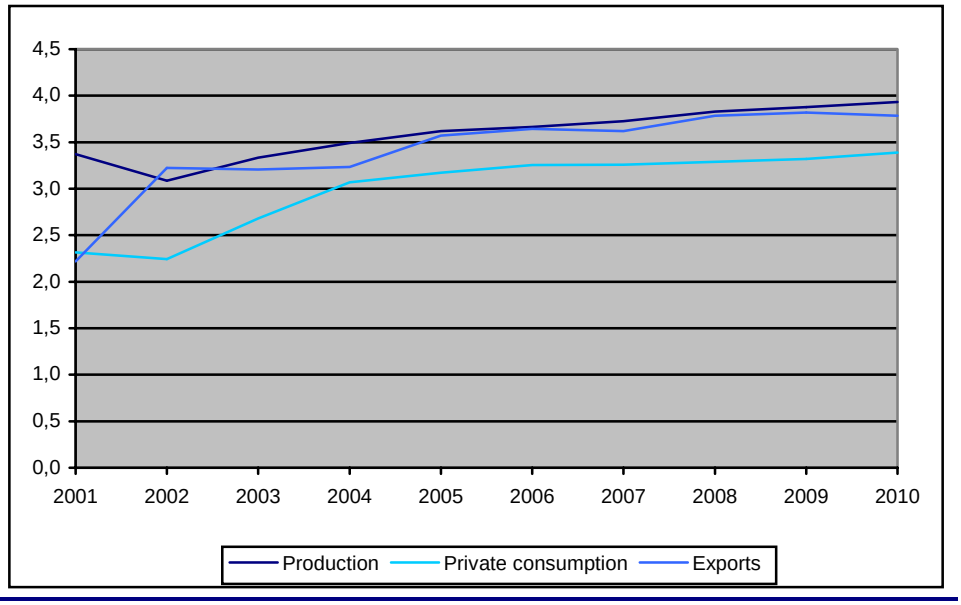

Chart 40. Gas, per cent

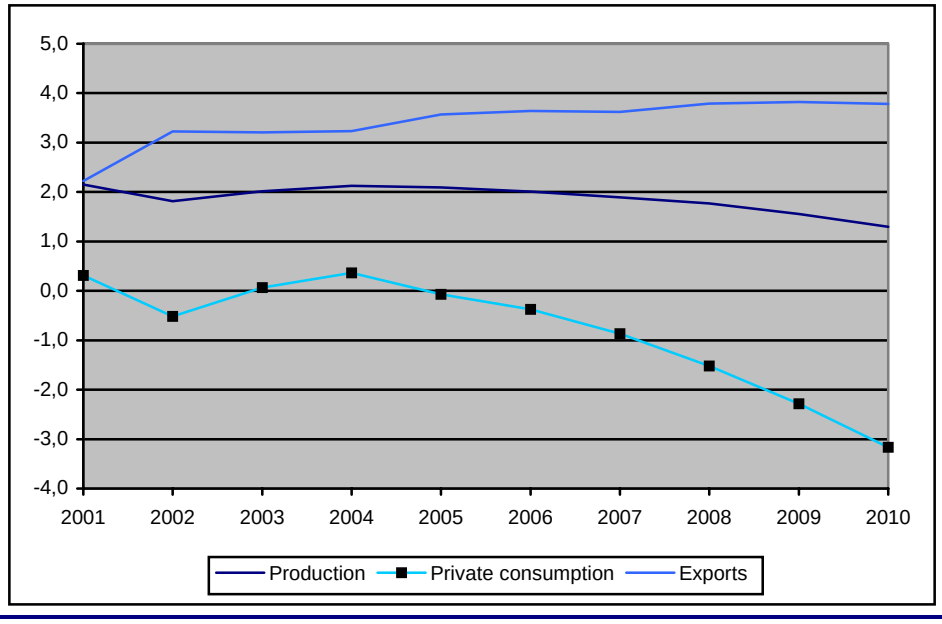

Chart 41. Steam and hot water, per cent

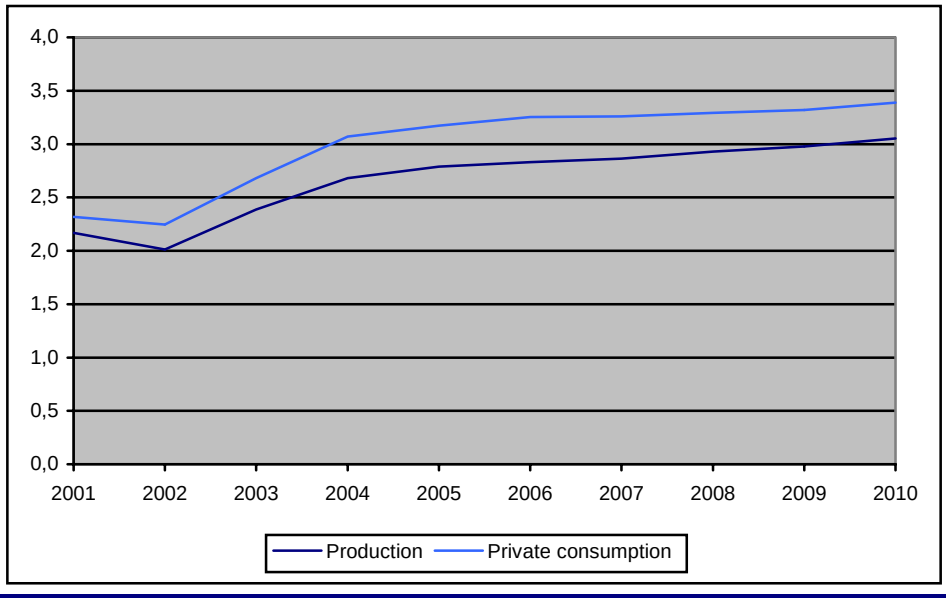

Chart 42. Construction, per cent

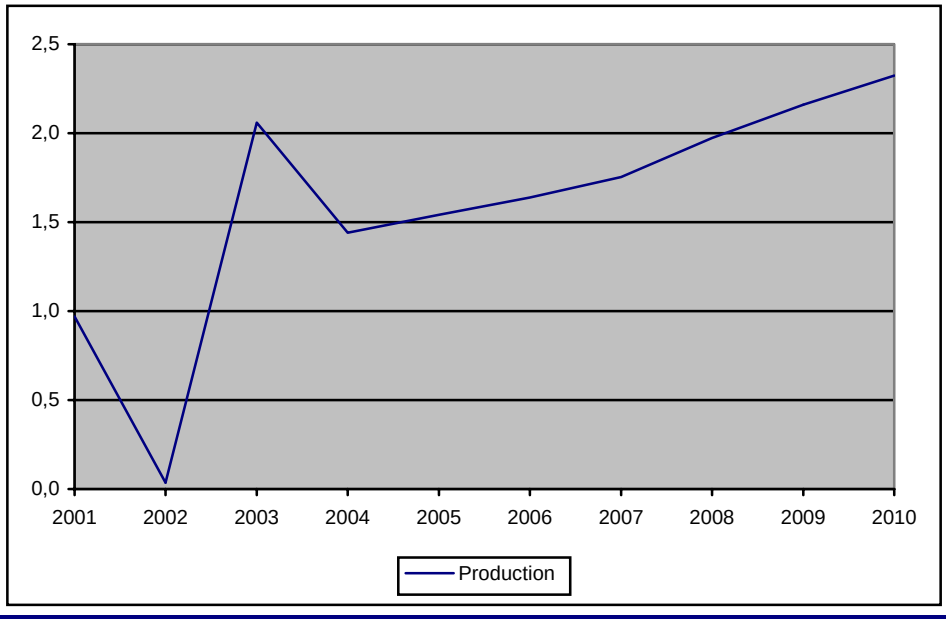

Chart 43. Motor vehicle service, per cent

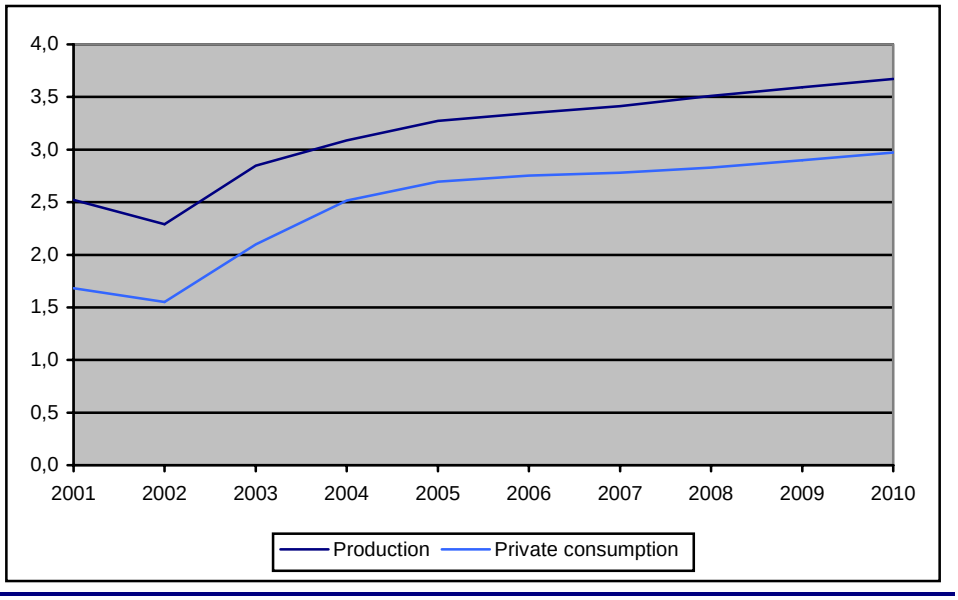

Chart 44. Wholesale trade, per cent

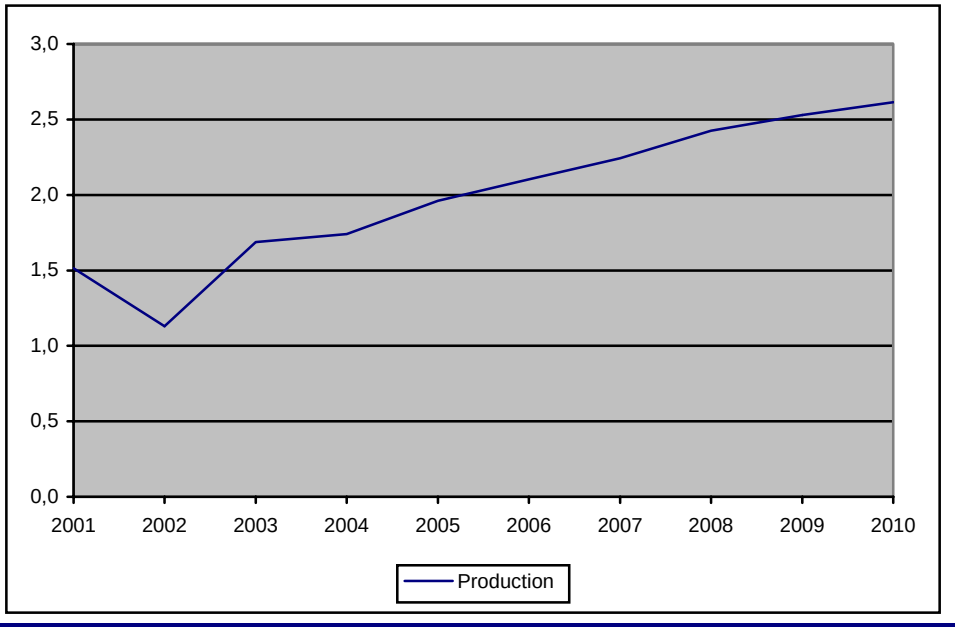

Chart 45. Retail trade, per cent

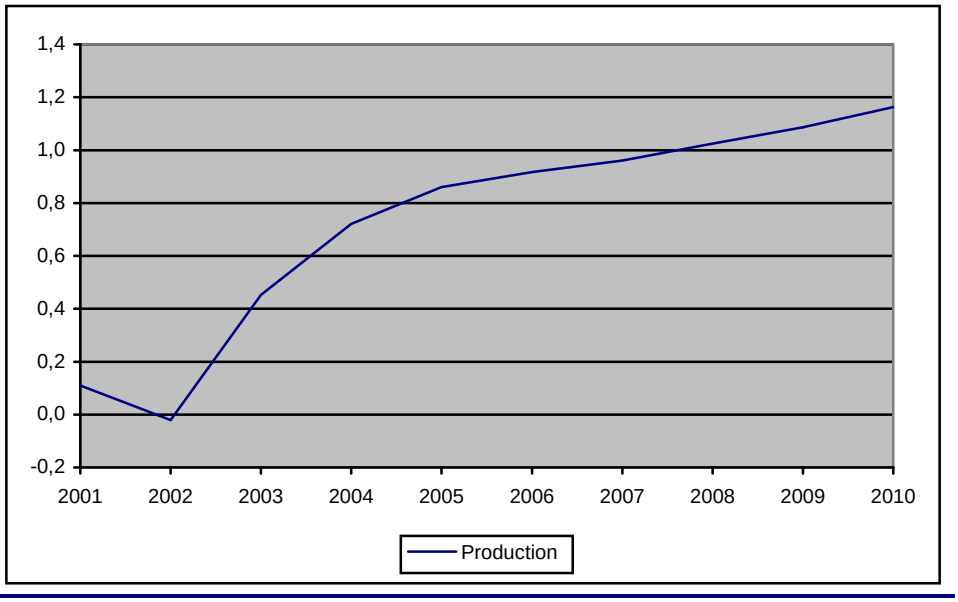

Chart 46 Freight transport, per cent

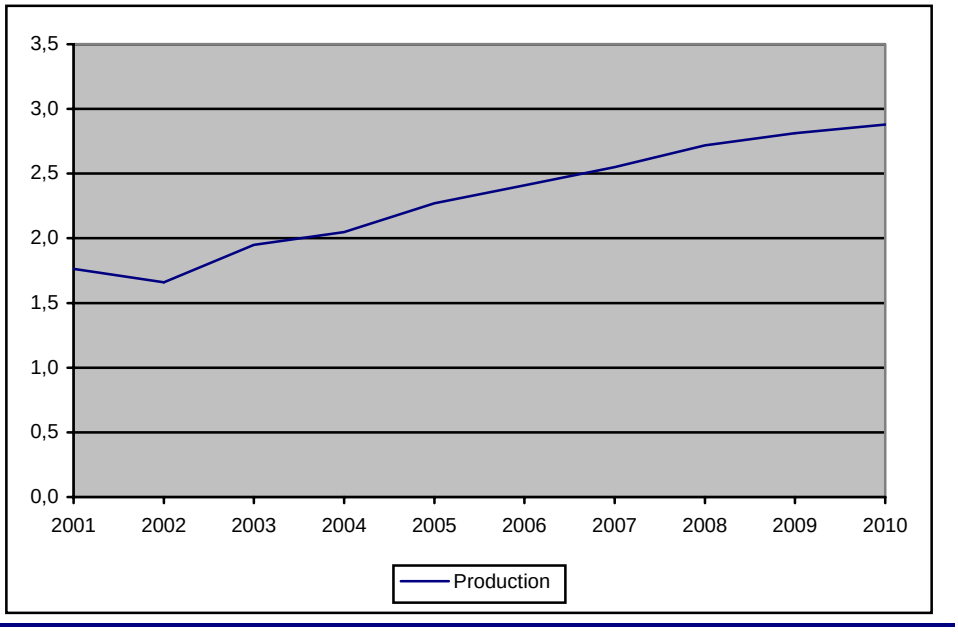

Chart 47. Financial and property services, per cent

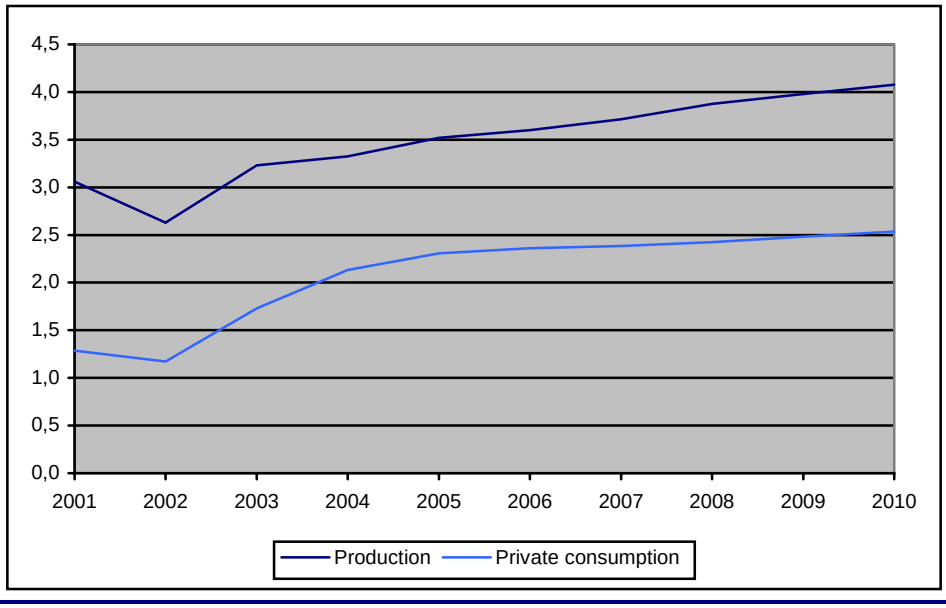

Chart 48. Transport and communication services, per cent

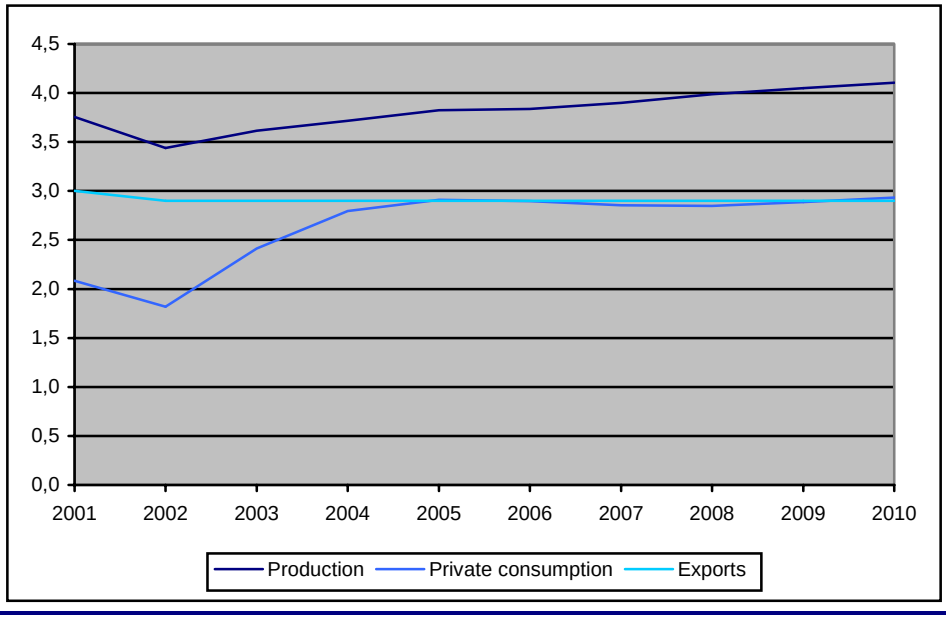

Chart 49. Public services, per cent

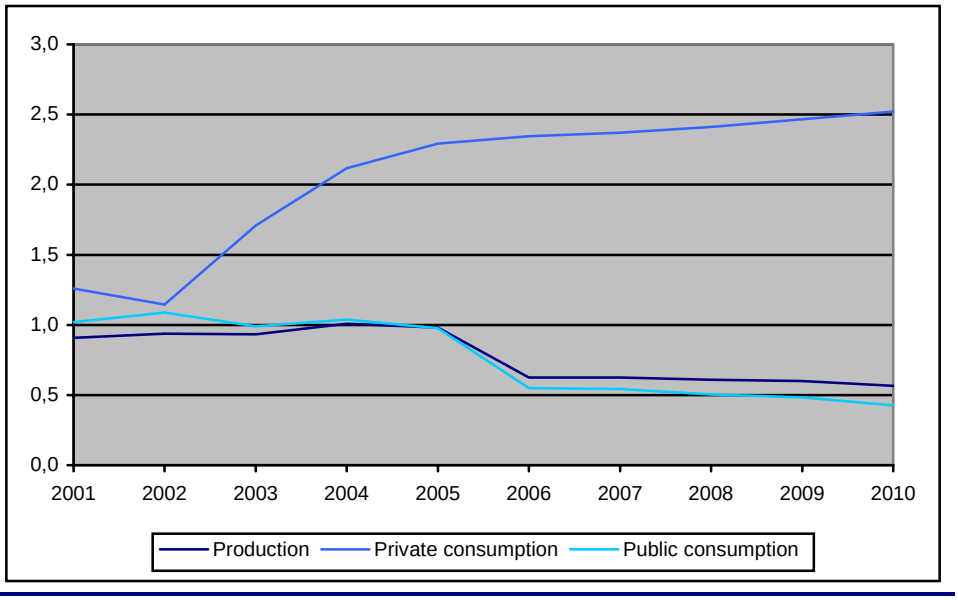
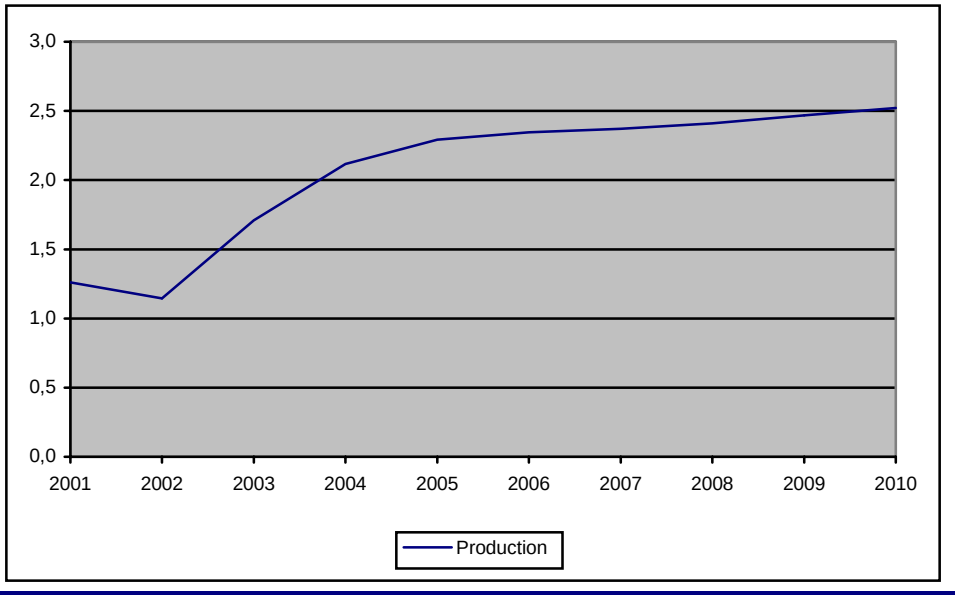
Chart 50. Dwelling ownership, per cent