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STRUCTURAL FORECASTS FOR THE DANISH ECONOMY USING THE DYNAMIC-AAGE MODEL

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Abstract

Traditionally, applied general equilibrium (AGE) models 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). The forecasting methodology developed for MONASH has now been applied to Dynamic-AAGE, the dynamic version of the Agricultural Applied General Equilibrium (AAGE) model of the Danish economy. The starting point for the Dynamic-AAGE forecasts is a set of scenarios for the macro economy supplied by a specialist-forecasting agency, currently the Danish Economic Council. Expert forecasts for major agricultural commodities and a detailed scenario on changes in technologies and household preferences are also drawn upon. The role of Dynamic-AAGE is to forecast a microeconomic picture for the Danish economy that is consistent with the macroeconomic scenarios and other inputs

The objective of this paper is to outline the forecasting methodology adopted in Dynamic-AAGE, and to describe the latest set of forecasts derived from the model. These forecasts have two main purposes. First they provide information to organisations that have to make decisions requiring views about the likely future structure of the economy. Prime examples are multi-industry, businesses concerned with the allocation of their resources, educational and training authorities concerned with anticipating chances in the allocation of the labour force, and the government concerned with the regional development of public infrastructure. The second main purpose of these forecasts is to provide a realistic base case from which to calculate the answers to the traditional "what if" questions.

Key words: Forecasts, Danish economy, CGE modelling.

1. Introduction

Dynamic-AAGE 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]. The forecasting methodology developed for MONASH has now been applied to Dynamic-AAGE to generate structural forecasts for the Danish economy. The starting point for the Dynamic-AAGE forecasts is a set of scenarios for the macro economy supplied by a specialist-forecasting agency, currently the Danish Economic Council. Expert forecasts for major agricultural commodities and a detailed scenario on changes in technologies and household preferences are also drawn upon. The role of Dynamic-AAGE is to forecast a microeconomic picture consistent with the macroeconomic scenarios and other inputs.

Later, in Section 4, we review aspects of the current set of Dynamic-AAGE forecasts. In Section 2, we summarise the theoretical structure of Dynamic-AAGE. Our forecasting methodology is outlined in Section 3. Section 5 contains concluding remarks.

2. Dynamic-AAGE

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 introduced from MONASH 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 Table 1). 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 single federal government. Finally, there are foreigners, whose behaviour is summarised by export demand curves for Danish products, and by supply curves for international imports.

[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).

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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 Table 1), 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 Federal 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)

Two categories of exports are defined: traditional, which are the main exported commodities, and non-traditional (see Table 1). 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.

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).

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2.2 From AAGE to Dynamic-AAGE: Inclusion of MONASH dynamics

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There are two main types of inter-temporal links incorporated into Dynamic-AAGE: physical capital accumulation and lagged adjustment processes.

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:

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

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

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

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. As in MONASH, 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.

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Lagged adjustment processes

MONASH contains a number of lagged adjustment processes, but just one is included in Dynamic-AAGE. This relates to the operation of the labour market.

In comparative static analysis, one of the following two assumptions is made about the real wage rate and employment, either the real wage rate adjusts so that any policy shock has no effect on aggregate employment, or the real wage rate is unaffected by the shock and employment adjusts. MONASH's treatment of the labour market allows 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. The same idea is applied in Dynamic-AAGE. 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.

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3. 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 at a level of detail consistent with the requirements of public and private organisations that require views about the likely future microeconomic structure of the economy, or that wish to assess the impact of policy (and other) changes on the microeconomic structure.

In generating the forecasts reported in this paper, we use :

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- macroeconomic forecasts from the Danish Economic Council;
- assumptions for changes in industry production technologies and in household preferences, based on numbers used with the MONASH model; and
- forecasts for the quantities of agricultural exports taken from a paper prepared at the Danish Research Institute of Food Economics.

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.

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

4. Forecasts for 1996 to 2010

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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.[3] Accordingly, the forecasts 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.

4.1 Exogenous variables

Macroeconomic inputs (Table 2)

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 forecast period the primary source is forecasts published by the Danish Economics 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. In the following we outline similarities and differences in the forecast closures for the two periods.

- In both periods we treat aggregate demand components of GDP as exogenous variables. Also, in both periods labour supply, aggregate employment, and the number of people receiving social pensions are targeted.
- With respect to prices we treat the nominal exchange rate and import prices in foreign currency as exogenous variables in both periods.
- The national accounts statistics include data on total compensation to employees while the forecasts include data on the nominal wage rate deflated by the consumer price index (the consumer real wage). Therefore, the aggregate wage bill is exogenous in the historical period, while the consumer real wage is exogenous in the forecast period. Likewise, the national accounts include data on the government's income tax revenue and total expenditures on unemployment benefits. Therefore, we target these revenue and expenditure levels in the historical period, while we treat the income tax rate and the average rate of unemployment benefit as exogenous in the forecast period.
- The national accounts include detailed information on the development in interest and dividend payments to and from abroad. Therefore, we target these payments in the historical period by freeing up the interest and dividend rates. In the forecast period we do not have such detailed information so we swap payments with interest and dividend rates.
- Finally, in the historical period the development of the government's interest payments are know so we exogenise the payments by endogenising the interest rate. In the forecast period we swap payments with interest rate.

Table 2 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.

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1995-2000 was a period of relatively high GDP-growth; the annual average being 2.7 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 aggregate investment was high; 6.7 per cent. In the forecast period we expect lower real GDP growth rates, and the trend switches so that real aggregate private consumption grows faster than GDP, and investment grows slower than GDP.

In the historical period public consumption increased by 1.5 per cent per year on average. In accordance with the government's declared goal we assume that public consumption increases by 1 per cent per year until 2005. From 2005 to 2010 we assume that public consumption moves with the demographic development.

[3] 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.

The rapid growth in international trade through the historical period reflects several factors: fast growth in the economies of our main trading partners, improvements in communications, and the rapid investment growth that enhances imports because investment is an import-incentive 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.

Assumptions for changes in technology and tastes (Table 3)

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, in part, on extrapolated trends for Australia calculated from a MONASH simulation for the period 1987 to 1996.

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.

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, poultry, fruit and vegetables reflect a trend towards healthier eating. The shift towards transport and communication services reflects the rapid adoption by 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 the trend against consumption of *17 Pig-meat products*. Over the 1990s, consumption of pig meat has contracted at an average rate of over five per cent. We also 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.[4]

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, superannuation and insurance.

[4] 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.

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 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.

Assumptions for Exports (Table 4)

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 that have export shares in total sales greater than 40 per cent, and commodities for which exports are a buffer between unanticipated changes in domestic demand and changes in output. For non-traditional exports, 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 included in this category. The first two commodities are not exported directly. Their "export sales" 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.

In the forecast we target the volume of total exports, the volumes of traditional exports, and the volumes of special exports. The total is targeted by equi-proportional horizontal shifts (price shifts) in the world demand schedules for all categories of export commodities. In order to target the volumes of traditional exports we allow for horizontal shifts in the world demand schedules for traditional export commodities. Finally, we target special export volumes by vertical shifts (quantity shifts) in the world demand for these commodities.

Table 4 shows the average annual growth rates of real traditional and special exports in the periods 1995-2000 and 2001-2010. In the historical period the sources are the international trade statistics and the agricultural statistics published by Statistics Denmark. In the forecast period we use the broad forecasts calculated by the Danish Economics Council supplemented by calculations done by the Danish Institute of Agricultural and Fisheries Economics concerning agricultural exports.[5]

Exports of *C1. Cereal* are a buffer between changes in domestic demand and unanticipated changes in output due to weather conditions. In the historical period cereal exports fell by 2.7 per cent per year on average. The reason is that the exports in 1995 were above normal due to favourable weather conditions, which allowed the industry to harvest an above-average amount of cereal of a quality suited for exports. In the forecast period exports increase by 3.1 per cent per year.

To our knowledge there are no individual forecasts regarding exports of *C10. Hunting and fur farming* and *C11. Horticulture* so we apply the general forecast for agricultural exports supplied by

[5] See Frandsen and Jensen (2000).

the Economics Council. 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.

During the last five years exports of *C16. Cattle meat* have 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. Through the forecast period we expect cattle meat to regain some of it's export market share, with exports forecast to grow at 2.6 per cent per year on average.

Exports of *C17. Pig-meat products* are 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 extraction of oil and gas in the North Sea will fall significantly in the future. This implies lower exports of *C14. Oil and gas*. In line with esimates from the Economics Council we assume that exports will fall by 10 per cent per year from 2000.

During the last years we have observed large growth rates in the exports of the special commodities. In the forecast period, this growth is expected to decrease substantially to 2.9 per cent per year on average, in line with the Economic Council's forecasts for service exports.

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4.2. Projections for industry output (Table 5)

Table 5 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 industry with the worst growth prospects is *14 Extraction of coal, oil and gas*. The industry with the best growth prospects is *28 Textile, wearing apparel and leather.* We work through Table 5 in industry order. In our discussion we make use of data in Tables 6 and 7, which show simulated-2000 values for the sales and cost patterns of individual commodities and industries.

1 Cereal (ranked no. 24)

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, 18 per cent was exported. Imported cereals accounted for almost 15 per cent of the local market.

Growth prospects for cereal grain production depend crucially on two factors: the output prospects of the pigs industry, and our assumptions for exports (Table 4). Pig production is forecast to grow at an average annual rate of 1.4 per cent, while exports are assumed to grow at an annual rate of 3.1 per cent. The relatively strong growth in exports, however, is offset in our forecasts by strong growth in imports, leading to growth in cereal production in line with growth in pig production.

2 Oil seeds (ranked no. 25)

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. Over a third of its production is exported, while imports supply around 40 per cent of the local market.

Production of oil seeds is forecast to grow at an average annual rate of 1.4 per cent. This is in line with our forecast for export growth of 1.3 per cent.[6] We are forecasting comparatively slow

[6] In our modelling, oilseeds are classed as a non-traditional exports. We assume that all non-traditional exports grow at the same rate through the forecast period (on average, 1.3 per cent per annum). This rate is implied by our assumptions for total exports (Table 2) and for the exports of traditional commodities (Table 4).

growth in the industry's domestic sales, due, in the main, to the relatively poor prospects for production of *20 Processed oils and fats.*

3 Potatoes (ranked no. 19)

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

The potato industry has growth prospects a little above those of the cereal and oilseed industries, reflecting stronger forecast growth in domestic sales. Sales to potato's main industrial customer (*19 Processed fruit and vegetables*) are forecast to grow at an annual rate of 3.1 per cent, while demand private consumption of potatoes is forecast to expand at the rate of 1.8 per cent.[7]

4 Sugarbeets (ranked no. 29

Sugarbeet is a 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 *I19 Processed fruit and vegetables.* Our forecast for average annual growth in the industry is 1.2 per cent, somewhat below its historical growth rate of 2.1 per cent. This is in line with production of refined sugar, which is forecast to grow at an annual rate of 1.3 per cent, compared with growth of 2.2 per cent in the historical period.

5 Roughage (ranked no. 47)

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 annual rate of 0.2 per cent. We expect a similar rate of decline over the forecast period.

6 Meat cattle and milk producers (ranked no. 46)

This industry produces two products, cattle for slaughter and milk. 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. An equally small proportion of milk is sold directly to household consumption. 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. We assume that this quota will remain in place at its current level through the forecast period, implying zero change in meat cattle and milk production.

7 Pigs (ranked no. 26)

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 2.7 per cent per annum in the period 1995 to 2000, to 1.4 per cent in the period 2000 to 2010.

8 Poultry (ranked no. 20)

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*. Seven per cent of the combined output of the industry is exported. Imports make up 8 per cent of domestic sales.

[7] Private consumption is forecast to growth at an average annual rate of 2.3 per cent (Table 2). 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.

We expect poultry production to increase at an annual rate of 1.7 per cent, compared with growth of 2.9 per cent in the historical period. Lower growth is consistent with our forecasts of reduced growth in *17 Poultry-meat products.*.

9 Hunting and fur farming, etc. (ranked no. 17)

This is a highly trade exposed industry. Exports comprise 60 per cent of its total sales, while import penetration on the local market is over 35 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 4), and an increase in import penetration on the domestic market. Despite these factors, our forecast for annual production growth in this industry is 1.8 per cent. 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 4.6 per cent.

10 Horticulture (ranked no. 31)

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

Relative slow export growth (Table 3), further increases in import penetration 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 1.1 per cent per annum.

11 Agricultural services (ranked no. 39)

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 0.6 per cent.

12 Forestry (ranked no. 27)

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 the government.

Our forecast average-annual growth rate for this industry is 1.3 per cent. This compares to growth of 2.7 per cent between 1995 and 2000. The main reason for reduced growth is a downturn in domestic sales of wood to wood manufacturers (industry 40). Another reason is relatively slow growth in government consumption (Table 2).

13 Fishing (ranked no. 48)

This is a very trade-exposed industry, with half of its production exported, and with imports meeting over 50 per cent of domestic demand. Fishing products not produced for export are sold mainly to downstream processors in *18 Fish Products*

Fishing output fell slightly in the historical period. We expect a similar rate of decline in our forecasts. The main reason is increased import penetration, combined with relatively poor export prospects (Table 3).

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 ten 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.

15 Cattle-meat products (ranked no. 45)

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 4.1 per cent (Table 4). 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.

16 Pig-meat products (ranked no. 23)

This is, by far, the largest meat processing industry. It is highly export oriented, with nearly 60 per cent of its production destined for overseas. In 2000, around twenty per cent of production was sold directly to consumption. This share has fallen significantly in recent years due to an adverse shift in consumer preferences (Table 3).

We are forecasting output growth in this industry of 1.5 per cent per annum. In making this forecast, we assume that exports will grow by 1.8 per cent per annum (Table 4). We have also assumed that the share of pig meat purchases in total consumption will fall in line with recent trends.

17 Poultry-meat products (ranked no. 16)

Poultry meat is mainly produced for export, with most domestic demand met from imports. Production of poultry meat is forecast to grow at an average annual rate of 1.9 per cent. This is considerably below its historical rate of growth, but is above the forecast growth rates of other meat producers. We expect exports of poultry meat to increase at the annual rate of 1.3 per cent, in line with the forecast growth rate of non-traditional exports. We are also forecasting a slight decrease in import penetration on the local market.

18 Fish products (ranked no. 33)

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 1.0 per cent per year, in line with recent history. This reflects our assumption for exports (Table 4).

19 Processed fruit and vegetables (ranked no. 11)

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 3.1 per cent per year, considerably 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.*

20 Processed oils and fats (ranked no. 30)

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 a low 1.2 per cent per annum. This reflects slow growth in industrial demand, particularly from the pigs industry, and our assumption of a mild adverse shift in consumer preferences (Table 3).

21 Dairy products (ranked no. 44)

This industry produces fresh milk and manufactured milk products. Fresh milk is sold directly 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 0.3 per cent per annum, reflecting increased efficiency in the manufacture of milk products from an unchanged supply of primary input.

22 Starch, chocolate products, etc. (ranked no. 21)

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

We are forecasting output growth for this industry of 1.6 per cent per annum. We expect the industry's output growth to be restrained by an adverse shift in consumer preferences (Table 3). Against this, though, we are assuming quite strong growth in exports of 3.0 per cent per year (Table 4)

23 Bread, grain mill and cakes (ranked no. 35)

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).

Being strongly oriented towards consumption makes prospects for growth in this industry highly depended on growth in consumption and changes in consumer preferences. We assume that private consumption will grow at an average annual rate of 2.3 per cent (Table 2). 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 only 0.9 per cent per year.

24 Bakery shops (ranked no. 42)

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. Our forecast for output growth is 0.5 per cent per year. Like the products produced by industry 23, bakery output is heavily constrained by adverse shifts in consumer tastes (Table 3).

25 Sugar factories and refineries (ranked no. 28)

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 20 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 1.3 per cent per year. This is the same as the forecast output growth rate for this industry.

26 Beverage production (ranked no. 34)

Households consume nearly half of the beverage industry's production, while a quarter is exported. Import penetration is quite high at over 30 per cent. Our forecast growth rate for the industry is 1.0 per cent per year. This is well below our forecast for consumption growth, reflecting an adverse trend in consumer preferences (Table 3).

27 Tobacco manufacture (ranked no. 43)

The main markets for this industry are overseas (exports comprise over half of total sales). Locally, a large proportion of the market is met from imports. Currently, the industry is being harmed from a strong shift in consumer preferences against its products. We assume that this trend will continue through the forecast period, resulting in output growth of just 0.4 per cent per year.

28 Textiles, wearing apparel and leather (ranked no. 1)

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 nearly all of the local market is supplied by imports (import penetration is around 98 per cent), and nearly all of production is exported (the industry's export propensity is also about 98 per cent).

Our forecasts take these developments into account. The industry no longer faces import competition, because it hardly sells to the local market. Its growth prospects are now determined almost entirely by prospects for export growth. We have assumed that exports will grow at an average annual rate of 4.7 per cent (Table 4). This implies a growth rate in output of 4.6 per cent, making this industry the fastest growing sector in the economy.

29 Manufactured wood and glass products (ranked no. 40)

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.

This industry owes its low output ranking in our forecasts (40^{th}) to two factors. First, we are assuming that aggregate investment will grow at an average annual rate of only 1.1 per cent in the forecast period (Table 2). 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. 41)

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. 10)

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 3.2 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 4.7 per cent (Table 4). This more than offsets weak growth in domestic sales. We assume that the economy becomes more efficient in its usage of petroleum products, adverse shifts in both household preferences and industry technologies (Table 3).

32 Basic chemicals (ranked no. 3)

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).

33 Fertiliser (ranked no. 32)

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 subdued in line with poor growth prospects of the primary agricultural industries.

34 Agricultural chemicals nec (ranked no. 5)

This industry produces a range of miscellaneous agricultural chemicals that 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 4).

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 (35^{th}) stems from a combination of weak overall investment growth (Table 2) 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. 7)

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, with import penetration on the local market is over 70 per cent.

This industry has relatively good growth prospects in the forecast period. It benefits from strong export growth (Table 4), and from a favourable shift in industry technologies (Table 3).

37 Machinery and non-transport equipment (ranked no. 2)

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 imports 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).

Our forecast for output growth in this industry is 4.2 per cent per year. This reflects the strong export potential for the industry (Table 4), which more than offsets relatively subdued growth in local sales.

38 Transport equipment (ranked no. 4)

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 4). 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 4). However, we are forecasting that most of these additional sales will be of imported equipment.

39 Electricity (ranked no. 8)

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 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. 49)

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 at a rate of 10 per cent per annum severely limits scope for additional production of retail gas. Accordingly, production of gas for distribution is forecast to fall at the rate of 1.2 per cent per annum

41 Steam and hot water (ranked no. 13)

Like gas, steam and hot water are sold widely through the economy. The main use is for heating of residential homes. Our forecast for average annual growth of output in this industry is 2.6 per cent, somewhat above GDP growth of 1.6 per cent. In the forecast period, we expect the industry's growth to be elevated above that of GDP because of its relatively strong connection to consumption, which is forecast to grow at the rate of 2.3 per cent per year, combined with quite a high expenditure elasticity.

42 Construction (ranked no. 22)

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 2).

43 Motor vehicle services (ranked no. 12)

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 32, 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. 18)

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 yields forecast growth in the industry's output 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. 45)

Like the wholesale industry, this industry provides margin services. These services are provided to facilitate retail transactions. In our forecasts, private consumption grows at an average annual rate of 2.3 per cent (Table 2). However, our forecasts imply a growth rate for retail trade of 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. 15)

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 growth in international trade. As can be seen from Table 2, we are forecasting that international trade will growth by over four per cent per annum. Our forecast for freight output, though, is only 2.0 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. 9)

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 2). 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. 37)

This industry provides government and other public services. As is shown in Table 2, we are forecasting average annual growth in public consumption of 0.8 per cent. Our output forecast for public services is 0.8 per cent. In making this forecast, we have assumed mild adverse shifts in consumer preferences and industry technologies against public services (Table 3).

50 Dwellings (ranked no. 14)

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 are of 2.6 per cent (as forecast by the Danish Economic Council).

5. Conclusions

In this paper, we have reviewed the method for producing detailed forecasts of the industrial structure of the economy using the Dynamic-AAGE model. The forecasts include inputs from specialist macro forecasters and from experts in commodity markets. They also include detailed scenarios on changes in industry technologies and household tastes, without which realistic *structural* forecasts would be impossible.

The role of Dynamic-AAGE is to translate these inputs into forecasts for variables that are relevant to organisations with responsibilities that require them to take views about the future structure of the economy. We think that detailed forecasts will be of interest to a wide range of groups, including

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

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Table 1: 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 products	#	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 equipment	#	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 services		48 Financial and property services
	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. # Commodities classed as traditional export commodities (producers of traditional export commodities face individual downward-sloping world-demand schedules for exports).

Table 2: Macroeconomic Forecast

	Variable	1995 to 2000	2000 to 2010
	---------- average annual growth rates ----------		
1.	Real private consumption (C)	1.8	2.3
2.	Real investment (I)	6.7	1.1
3.	Real public consumption (G)	1.5	0.8
4.	International export volumes (X)	6.4	3.4
5.	International import volumes (M)	6.7	3.4
6.	Real GDP (Y)	2.7	1.6
7.	Labour supply	0.1	-0.1
8.	Aggregate employment	0.2	-0.0
9.	Aggregate capital stock	2.3	2.3
10.	Nominal wage	4.9	3.6
11.	Consumer real wage	3.0	2.1
12.	Producer real wage	2.3	2.0
13.	CPI	1.9	1.4
14.	Terms of trade	1.2	-0.1
15.	Real devaluation of exchange rate	-2.3	-0.5
	---------- per cent, end of period ----------		
16.	Unemployment/labour supply	6.1	5.1
17.	Net external debt/GDP	17.5	-9.6
18.	Public debt/GDP	56.9	33.5

.

Table 3: Industry Technology and Household Taste Assumptions (average annual percentage changes)

	Commodity	Household preferences[a]	Industry technology:	
			Intermediate input-using[b]	Primary-factor using[c]
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
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	-1.0	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
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.

Table 4: Assumptions for Export Volumes
(average annual growth rates)

	Commodity	1995 to 2000	2000 to 2010
Agricultural and fisheries commodities			
1.	Cereal	-2.7	3.1
10.	Hunting and fur farming etc.	4.6	1.2
11.	Horticulture	5.4	1.2
14.	Fishing	2.8	1.0
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
Extraction of oil and gas			
15.	Extraction of oil and gas	6.1	-10.0
Industrial commodities			
29.	Textile, wearing apparel and leather	11.6	4.7
32.	Oil refinery products	6.4	4.7
33.	Basic chemicals	6.1	4.7
35.	Agricultural chemicals nec	6.9	4.7
37.	Metal products	4.8	4.7
38.	Machinery & non-transport equipment	7.3	4.7
39.	Transport equipment	10.2	4.7
Services			
45,47,49	Special export commodities	9.2	2.9

Table 5: Industry Output
(average annual growth rates)

Deleted: *16*

Rank		Industry	1995 to 2000	2000 to 2010
24	1	Cereal	1.1	1.4
25	2	Oil seeds	2.6	1.4
19	3	Potatoes	1.7	1.7
29	4	Sugerbeets	2.1	1.2
47	5	Roughage	-0.2	-0.2
46	6	Meat cattle and milk producers	0.0	0.0
26	7	Pigs	2.7	1.4
20	8	Poultry	2.9	1.7
17	9	Hunting and fur farming, etc.	2.9	1.8
31	10	Horticulture	2.6	1.1
39	11	Agricultural services, etc.	1.3	0.6
27	12	Forestry	2.7	1.3
48	13	Fishing	-0.1	-0.2
50	14	Extraction of coal, oil and gas	2.1	-10.0
45	15	Cattle-meat products	-0.6	0.2
23	16	Pig-meat products	2.7	1.5
16	17	Poultry-meat products	4.2	1.9
33	18	Fish products	0.9	1.0
11	19	Processed fruit and vegetables	3.0	3.1
30	20	Processed oils and fats	2.2	1.2
44	21	Dairy products	0.3	0.3
21	22	Starch, chocolate products, etc.	1.7	1.6
35	23	Bread, grain mill and cakes	1.8	0.9
42	24	Bakery shops	0.5	0.5
28	25	Sugar factories and refineries	2.2	1.3
34	26	Beverage production	1.1	1.0
43	27	Tobacco manufacture	1.7	0.4
1	28	Textile, wearing apparel and leather	-0.5	4.6
40	29	Manufactured wood and glass products	2.6	0.6
41	30	Paper products and publishing	1.2	0.6
10	31	Oil refinery products	4.0	3.2
3	32	Basic chemicals	4.3	4.0
32	33	Fertiliser	1.4	1.1
5	34	Agricultural chemicals nec	4.4	3.8
36	35	Non-metallic building material	3.2	0.9
7	36	Metal products	3.3	3.6
2	37	Machinery & non-transport equipment	5.8	4.2
4	38	Transport equipment	6.7	3.9
8	39	Electricity	3.9	3.3
49	40	Gas	3.3	-1.2
13	41	Steam and hot water	2.5	2.6
22	42	Construction	5.0	1.6
12	43	Motor vehicles service	3.5	3.1
18	44	Wholesale trade	3.5	1.8
38	45	Retail trade	0.5	0.7
15	46	Freight transport	3.8	2.0
9	47	Financial and property services	4.4	3.3
6	48	Transport and communication services	6.3	3.7
37	49	Public services	1.5	0.8
14	50	Dwelling ownership	1.5	2.1

Table 6: Sales Shares for Commodities in the 2000 AAGE database

	Commodities	Share in total sales of sales to:								Import share in local market
		Industries	Invest.	Consum.	Exports	Gov.	Stocks	Margins	Total	
1	Cereal	74.7	0.0	3.0	17.8	0.0	4.5	0.0	100.0	14.8
2	Oil seeds	60.4	0.0	1.6	37.5	0.0	0.4	0.0	100.0	42.7
3	Potatoes	56.8	0.0	17.9	23.4	0.0	1.9	0.0	100.0	35.9
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	86.5	2.4	3.3	8.2	0.0	-0.4	0.0	100.0	13.6
7	Milk	97.7	0.0	2.0	0.0	0.0	0.3	0.0	100.0	0.2
8	Pigs	98.3	0.0	0.0	1.9	0.0	-0.3	0.0	100.0	0.0
9	Poultry	73.6	0.0	19.4	7.3	0.0	-0.4	0.0	100.0	7.8
10	Hunting and fur farming, etc.	25.8	0.0	0.0	60.0	0.0	14.2	0.0	100.0	36.1
11	Horticulture	13.8	0.0	31.2	54.6	0.0	0.5	0.0	100.0	55.1
12	Agricultural services, etc.	83.3	0.0	1.5	0.0	15.2	0.0	0.0	100.0	0.0
13	Forestry	54.8	0.0	11.2	32.3	0.0	1.6	0.0	100.0	20.5
14	Fishing	41.2	0.0	1.1	56.2	0.0	1.5	0.0	100.0	52.2
15	Extraction of coal, oil and gas	50.7	0.5	0.0	48.3	0.0	0.4	0.0	100.0	51.0
16	Cattle-meat products	10.3	0.0	30.9	60.2	0.0	-1.4	0.0	100.0	44.0
17	Pig-meat products	23.7	0.0	16.7	60.5	0.0	-0.9	0.0	100.0	8.2
18	Poultry-meat products	8.3	0.0	9.0	83.3	0.0	-0.5	0.0	100.0	60.4
19	Fish products	27.9	0.0	2.3	70.4	0.0	-0.7	0.0	100.0	51.0
20	Processed fruit and vegetables	32.7	0.0	41.3	26.8	0.0	-0.8	0.0	100.0	38.0
21	Processed oils and fats	51.6	0.1	6.1	40.8	0.0	1.4	0.0	100.0	68.3
22	Dairy products	18.5	0.1	25.0	55.6	0.0	0.9	0.0	100.0	23.2
23	Starch, chocolate products, etc.	28.1	0.1	19.4	52.2	0.0	0.1	0.0	100.0	45.3
24	Bread, grain mill and cakes	19.3	0.6	35.6	44.6	0.0	-0.1	0.0	100.0	20.6
25	Bakery shops	21.8	0.3	77.9	0.0	0.0	0.0	0.0	100.0	0.0
26	Sugar factories and refineries	54.0	0.1	3.8	38.1	0.0	4.0	0.0	100.0	21.6
27	Beverage production	24.0	0.2	43.7	30.2	0.0	1.8	0.0	100.0	32.1
28	Tobacco manufacture	3.1	0.0	38.2	60.1	0.0	-1.4	0.0	100.0	35.3
29	Textile, wearing apparel and leather	0.0	0.1	0.1	97.9	0.1	1.8	0.0	100.0	98.6
30	Manufactured wood and glass products	49.6	3.7	2.4	42.2	0.0	2.0	0.0	100.0	50.5
31	Paper products and publishing	68.1	1.1	13.5	16.8	0.1	0.4	0.0	100.0	28.2
32	Oil refinery products	31.0	0.1	22.7	50.6	0.0	-4.4	0.0	100.0	45.3
33	Basic chemicals	26.8	1.3	2.1	68.5	0.7	0.6	0.0	100.0	67.5
34	Fertiliser	57.2	0.3	2.9	42.1	0.0	-2.5	0.0	100.0	64.9
35	Agricultural chemicals nec	23.4	0.0	0.8	78.4	0.0	-2.6	0.0	100.0	62.4
36	Non-metallic building material	73.9	1.7	1.3	22.3	0.0	0.8	0.0	100.0	16.5
37	Metal products	47.2	1.8	0.4	49.2	0.0	1.4	0.0	100.0	71.2
38	Machinery and non-transport equipment	22.6	13.8	2.8	59.4	0.2	1.2	0.0	100.0	60.3
39	Transport equipment	16.6	28.9	1.5	53.2	0.1	-0.2	0.0	100.0	68.4
40	Electricity	58.4	0.5	36.4	4.7	0.0	0.0	0.0	100.0	2.0
41	Gas	52.2	0.0	32.7	14.9	0.0	0.2	0.0	100.0	0.8
42	Steam and hot water	32.8	0.0	67.2	0.0	0.0	0.0	0.0	100.0	0.0
43	Construction	23.7	68.2	3.4	0.1	4.6	0.0	0.0	100.0	0.0
44	Motor vehicles service	42.2	0.3	57.4	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	0.1
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	52.7	10.1	24.4	2.4	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	8.5	0.4	84.0	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	42.7
55	Insecticides	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	38.9
56	Herbicide	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	80.8

Table 7: Cost Shares for Industries in the 2000 AAGE database

	Industries	Share in total costs of:					
		Intermediates	Labour	Capital	Land	Other	Total
1	Cereal	81.2	21.4	29.2	-19.0	-12.9	100.0
2	Oil seeds	85.5	14.9	12.0	-7.3	-5.1	100.0
3	Potatoes	44.9	9.1	44.3	2.3	-0.7	100.0
4	Sugerbeets	56.5	13.7	27.5	2.9	-0.7	100.0
5	Roughage	79.5	6.6	10.7	4.0	-0.8	100.0
6	Meat cattle and milk producers	54.2	14.0	11.5	0.0	20.2	100.0
7	Pigs	74.8	7.2	18.8	0.0	-0.8	100.0
8	Poultry	57.3	7.6	35.8	0.0	-0.7	100.0
9	Hunting and fur farming, etc.	45.7	6.0	49.6	0.0	-1.3	100.0
10	Horticulture	44.4	37.6	20.0	0.4	-2.3	100.0
11	Agricultural services, etc.	48.1	29.8	21.9	0.0	0.2	100.0
12	Forestry	55.5	25.7	16.1	0.0	2.7	100.0
13	Fishing	46.9	21.9	32.7	0.0	-1.6	100.0
14	Extraction of coal, oil and gas	19.9	4.9	70.9	0.0	4.3	100.0
15	Cattle-meat products	87.1	20.0	0.2	0.0	-7.3	100.0
16	Pig-meat products	78.9	14.6	6.6	0.0	-0.1	100.0
17	Poultry-meat products	79.0	18.6	2.5	0.0	-0.1	100.0
18	Fish products	79.6	14.9	5.5	0.0	0.0	100.0
19	Processed fruit and vegetables	77.4	14.1	8.5	0.0	0.1	100.0
20	Processed oils and fats	86.0	10.2	3.7	0.0	0.2	100.0
21	Dairy products	85.8	11.0	4.0	0.0	-0.8	100.0
22	Starch, chocolate products, etc.	73.4	17.4	9.0	0.0	0.1	100.0
23	Bread, grain mill and cakes	62.9	22.7	14.3	0.0	0.0	100.0
24	Bakery shops	48.3	32.5	19.5	0.0	-0.3	100.0
25	Sugar factories and refineries	62.6	12.6	28.5	0.0	-3.7	100.0
26	Beverage production	62.6	19.9	17.1	0.0	0.3	100.0
27	Tobacco manufacture	55.0	11.1	33.8	0.0	0.2	100.0
28	Textile, wearing apparel and leather	64.0	23.8	12.1	0.0	0.1	100.0
29	Manufactured wood and glass products	60.8	28.7	10.6	0.0	-0.1	100.0
30	Paper products and publishing	56.5	37.2	6.2	0.0	0.0	100.0
31	Oil refinery products	96.3	4.1	0.2	0.0	-0.5	100.0
32	Basic chemicals	56.0	25.4	18.6	0.0	0.1	100.0
33	Fertiliser	78.1	16.3	6.0	0.0	-0.3	100.0
34	Agricultural chemicals nec	59.4	34.3	7.0	0.0	-0.7	100.0
35	Non-metallic building material	54.5	30.0	15.3	0.0	0.2	100.0
36	Metal products	66.5	16.9	16.7	0.0	-0.1	100.0
37	Machinery and non-transport equipment	58.5	28.9	12.6	0.0	0.1	100.0
38	Transport equipment	63.1	29.6	8.7	0.0	-1.4	100.0
39	Electricity	33.5	19.0	47.1	0.0	0.4	100.0
40	Gas	40.8	7.6	51.7	0.0	-0.1	100.0
41	Steam and hot water	34.1	7.3	58.4	0.0	0.2	100.0
42	Construction	62.3	29.3	7.9	0.0	0.5	100.0
43	Motor vehicles service	65.5	27.7	7.3	0.0	-0.5	100.0
44	Wholesale trade	41.6	36.3	21.3	0.0	0.8	100.0
45	Retail trade	35.0	39.3	25.5	0.0	0.1	100.0
46	Freight transport	48.2	27.3	22.0	0.0	2.5	100.0
47	Financial and property services	39.1	30.7	29.6	0.0	0.5	100.0
48	Transport and communication services	33.4	25.0	23.0	0.0	18.6	100.0
49	Public services	26.8	61.2	11.4	0.0	0.6	100.0
50	Dwelling ownership	14.7	45.1	39.5	0.0	0.7	100.0