

Summary

Food supply in the Netherlands under exceptional crisis conditions

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Summary

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S.1 Conclusions

For this study we conducted a mental exercise to see whether the Dutch agricultural sector would be able to produce enough food for the country's population of 17 million inhabitants under exceptional crisis conditions. The crisis we postulated was an autarky situation, in which import and export are no longer possible. The conclusions of the study are as follows.

1. In an autarky situation, the Dutch agricultural sector is capable of feeding 17 million mouths.
2. The transition from the current situation to one of autarky would require very substantial changes to both agricultural production and the national diet.
3. The 'menu' in an autarky situation, as derived from the model calculations, rather differs from the current pattern of food consumption. But because the model does not utilise all the agricultural land in the Netherlands, there would be some scope to offer a more varied diet. Moreover, citizens would be inclined to supplement their menu with food produced by themselves.
4. The policy scenario reveals that there are three distinct phases in the process of adjusting production and consumption from the point at which international trade ceases to the establishment of a stable, autarchic agricultural sector.
5. Many of the adaptations on the production side could be left to market forces. That is not so much the case on the consumption side, where more rigorous government intervention to guide the process of adjustment would be needed in order to prevent unequal distribution of the available food to the Dutch population

S.2 Results

Dutch agriculture could feed 17 million people

As derived from the model calculations in all six autarky scenarios considered (see below), the Dutch agricultural sector was found capable of supplying the country's population of 17 million inhabitants with a varied diet of both animal

and crop products, providing each person with over a 2000 calories a day. To achieve this, however, patterns of both agricultural production and food consumption would have to change substantially. The most striking differences compared with the current situation are the limited consumption of grain products (including bread), the complete absence of pork and the relative prominence of potatoes, chicken, and eggs in the diet. These changes come about because the Autarky Model (see below) assumes that the organisation of Dutch agriculture would be greatly simplified, with minimisation of land use. When two products deliver the same nutrients, the model always chooses the one which requires the least amount of farmland. This explains why pork disappears from the menu: much less land is needed to produce the same volume of chicken meat, with a comparable nutritional value. In all six scenarios, the agricultural area in the Netherlands can easily meet the food needs of the population. Depending upon the assumptions made concerning yield per hectare and per animal, between about 45 and 90 per cent of the total amount of Dutch agricultural area would be needed to feed the nation adequately (see Table S.1).

Three phases of adjustment

The process of adjustment from the point at which import and export cease to the establishment of a stable, autarchic agricultural sector can be divided into three distinct phases: a period of initial transition, a pre-stabilisation year, and the final, stabilised situation (see Figure S.1). The end of international trade could happen at any time of year. From that moment on, the Netherlands would be reliant solely upon ongoing domestic production and its existing stocks of food, animal feeds, and other imported resources. Animal products are supplied all year round, but cereals, potatoes, sugar beet, and fruit are harvested on an annual basis. Current production cycles might be either interrupted or completed, depending upon the availability of resources and their cost. Once all ongoing production cycles have ended - we assume that this would be at the beginning of October, once the harvest is in - Production Year 1 would begin. This is the second phase of the process, the year prior to stable autarky. During this period it is unlikely that the national system of production and consumption can be organised entirely as outlined in the Autarky Model, since not all the seed stock, feed and animals needed for agricultural production and foodstuffs needed for consumption will be available. These have to be produced in the first production year, so that they can be utilised from Production Year 2 onwards. Only then do agricultural production and food consumption fall into line with the patterns described in the model.

Table S.1 Amount of agricultural land (x 1,000 ha) required in the Netherlands under each of the six autarky scenarios

	Scenario						Current (2010) use
	minimum-low	minimum-high	maximum-low	maximum-high	healthy-low	healthy-high	
Cereals (a)	217	152	217	152	260	177	219
Ware potatoes	83	58	42	27	83	58	158
Sugar beet	59	39	46	32	101	70	71
Oilseed rape	106	74	300	210	133	95	3
Legumes	98	69	98	69	98	69	4
Field vegetables (b)	66	44	52	36	60	42	42
Greenhouse vegetables	5	5	5	5	5	5	5
Fruit	19	19	19	19	19	19	19
Pasture	923	334	923	334	923	334	995
Total area required for produce above	1,577	795	1,703	885	1,683	870	1,516
Total area as percentage of agricultural land in the Netherlands (c)	84	42	91	47	90	46	81
Unused area in the scenarios (d)	274	1,056	148	966	168	981	

(a) Wheat, rye, summer barley and winter barley; (b) Carrots, cabbages, leeks and onions; (c) The total area of agricultural land in the Netherlands is 1.9 million ha (see Table 2.5); (d) Total agricultural land area minus area required for food supply minus area under permanent cultivation minus area used for greenhouse ornamental horticulture.

Sources: LEI Autarky Model; current (2010) land use from LEI/CBS, Land- en tuinbouwcijfers 2011 (annual overview of national agricultural and horticultural statistics).

Figure S.1 Phases in the process of adjustment from the point at which import and export cease to the establishment of stable autarky

1	2	3
year 0	production year 1	production years 2...n
Transitional period	Pre-stabilisation	Stable autarky

Four obstacles to adjustment

Potential obstacles in the process of adjustment to a system of stable autarky following the end of international trade arise in four areas of Dutch agriculture.

1. *Cereals*

Domestic grain production is sufficient to meet the demand for bread, but not that for animal feed as well.

2. *Oilseed rape and legumes*

Domestic production is insufficient to meet the demand for both edible rape-seed oil and vegetable proteins from legumes.

3. *Fruit*

Domestic production is insufficient to meet the recommended daily intake of two portions of fruit per person. This obstacle, however, can easily be overcome by increasing consumption of vegetables, which deliver almost exactly the same nutrients as fruit.

4. *Animal products*

Cessation of exports would create a huge surplus of animal products, whilst the inability to import would cause a shortage of animal feeds.

All things being equal, the free market can be expected to achieve a new equilibrium of supply and demand in an autarky situation. If the government were dissatisfied with the direction the market was taking, it could attempt to realign it. Such intervention would be most likely to be needed in the four areas listed above and might take the form of legislative and regulatory measures or efforts to influence market behaviour through information, incentives and facilitation.

Government intervention

Not long after the cessation of international trade, the Netherlands would be struck by shortages and surpluses of various products. Depending upon the timing of the interruption and the stocks held by Dutch companies and consumers, items soon in short supply would probably include cereals, edible vegetable oils, and fruit, while there could be surpluses of potatoes, sugar, milk, meat and eggs. This combination would require the 17 million people living in the Netherlands to modify their eating patterns and the country's 70,000 agricultural enterprises to change their production choices. Incentives for such adaptation could come through either government intervention or the effect of market forces. On the consumer side, for example, the government might consider setting up a national system of food distribution in order to prevent inequalities of supply to the population. In addition, the authorities could issue public information on how to prepare tasty meals using the foodstuffs still available. Inter-

ventions on the production side might include providing information concerning expected domestic demand for agricultural products, so that farmers could make well-informed decisions about what to produce. Other possibilities are making it compulsory to use a certain proportion of arable land to grow cereals, oilseeds, and legumes, introducing special measures to support dairy, sow and layer breeder farmers, and a system of animal production rights in intensive livestock farming. In preparation for a potential crisis situation, the Netherlands could perhaps consider following the example set by a number of other countries by creating a strategic reserve of certain foodstuffs. This applies especially to vegetable oil, which is a vital source of essential fatty acids.

S.3 Research questions and methodology

The Netherlands Ministry of Economic Affairs is currently updating its crisis management policy manual for national food supply (*Beleidsdraaiboek Crisisbeheersing Nationale Voedselvoorziening*). As part of this exercise, the Ministry needs to know whether, and how, the Netherlands can feed its own population in times of crisis. The scenario envisaged in this study is an autarky situation, in which imports and exports are no longer possible. That choice is a legacy of the approach taken when revising the policy manual in the late 1970s. Such a situation reflects a particularly extreme form of crisis, one barely conceivable for the Netherlands in the modern era of globalisation and supranational co-operation. For this reason, the picture provided here of a Dutch agricultural sector and food supply system operating under conditions of autarky should in no way be seen as representing a realistic future scenario. Rather, this study is intended as an exploration of the frontiers of food supply and agricultural production under exceptional crisis circumstances. From that point of view, an autarky situation provides a useful starting point from which this study can offer helpful guidance in updating the crisis management policy manual.

This study sought to answer three research questions:

1. Could the Dutch agricultural sector feed the country's population of 17 million inhabitants in the event of an exceptional food crisis, such as an autarky situation?
2. If so, how would the agricultural sector have to be organised in order to achieve that?

3. What changes would take place during the transition from the current situation to one of autarky, and in what ways could the government intervene in that process?

Approach: six scenarios for agricultural production and food supply

To find out whether a self-sufficient Dutch agricultural sector would be able to feed 17 million mouths, we first needed to know how much - and what - food all those people eat over the course of a year. In consultation with the Netherlands Nutrition Centre, we then devised three alternative dietary patterns: one with a limited menu (the 'minimum diet'), one based upon current eating habits (the 'maximum diet'), and a healthier version (the 'healthy diet'). On the production side, we needed to know how much agricultural land is available in the Netherlands and its yields per hectare and per animal. We assumed that, in an autarky situation, all available land would be used for food production and that overall yields would either be maintained at current levels ('high productivity') or fall somewhat ('low productivity'). This combination of three dietary patterns and two productivity levels produced a total of six scenarios, through which we have attempted to explore the extremes of agricultural production and food supply in a crisis situation.

Autarky Model applied to scenarios

To determine what and how much a self-sufficient Dutch agricultural sector would have to produce in order to provide the required intake of nutrients in each dietary pattern, we developed an optimisation model called the Autarky Model. This was then used to calculate how the quantity of food needed in each scenario could be produced utilising the least possible amount of land. The maximum area available was capped at just under 2 million hectares. Under the model, the agricultural sector can produce fourteen different products. It draws no distinction between individual agricultural enterprises - the entire sector is treated as one 'national farm', as it were. Nor does it indicate where in the country any specific item is produced: all it says is that a certain number of hectares of a crop need to be grown domestically, or a certain number of animals raised.

Core calculation: from nutrient to land area

In the Autarky Model, we use arithmetical conversion factors to establish a relationship between human nutritional requirements and agricultural land area. These can be presented in the form of flow charts, with the nutrient converted first into a foodstuff and then successively into basic ingredients, agricultural

produce and, finally, a number of hectares of land. As an example, below (Figure S.2) is the flow chart for bread.

