

## Agricultural productivity in the Low Countries ca 1800

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In the past few decades estimating the level of productivity of agriculture in the Netherlands has been a popular topic for agricultural historians. The so called Wageningen school has produced since the 1980s a number of voluminous studies into the development of the agricultural sector of various parts of the country in the period between ca 1500 and ca 1900, in which much attention is being paid to the level and development of productivity in these regions. Detailed statistics on different aspects of farming have been collected and analysed, and we now know a lot about cropping systems, the size and composition of the livestock, yields (of both livestock and crops) in various parts of the country – in particular the regions of Drenthe (Bieleman 1987), Groningen (Priester 1991), Zeeland (Priester 1998 and Van Cruyningen 2000), de Veluwe (Roessingh 1976), South-Holland (Baars 1973) and Limburg (Jansen 1979) have been studied carefully, not to mention the pioneering book by De Vries (1974) on the Dutch rural economy between 1500 and 1700, which covers much of the western and northern part of the country. To this may be added the research into levels of productivity in 19<sup>th</sup> century agriculture in the different regions of the Netherlands by Van Zanden (1985). In the southern Netherlands, a region partially covered by this paper, similar studies have been carried out within the framework of research into the historical national accounts of Belgium in the 18<sup>th</sup> and 19<sup>th</sup> century (by Kint (1989), Blomme (1993), Goossens (1993) and De Jongh (2000)), which has also produced a wealth of evidence concerning levels of productivity in different parts of the country.

Perhaps the most striking conclusion from this research is that there existed, even in this tiny fraction of the globe with ‘only’ a few million inhabitants, very large regional variations in farming systems and in levels of productivity. At about 1810 the yields for rye, for example, differed from 25 to 30 hl. on the clay soils in the western and northern part of Netherlands to 12 to 15 hl on the sandy soils of the eastern part of the country; milk yields of cows varied in a comparable way: from perhaps as high as 2500 to 3000 liters in the best dairy districts of Holland, Friesland and Flanders, to 1200 to 1500 liters on the sandy soils of the east. It is therefore not possible to reconstruct a typical Dutch farm, as every region has its own farming system and associated level of productivity. The alternative strategy that I will follow is, firstly, to sketch the different agricultural systems that existed in the northern Netherlands, including the very labour intensive agriculture of Flanders, which logically fits into the ‘model’ that I would like to present (the paper therefore not only covers the Netherlands, but also Flanders, but not the other parts of Belgium in which again other farming systems existed). I will present a number of case studies of levels of labour productivity in rye farming in different regions. Next I will turn to evidence on the regional level, comparing inputs and outputs of the agricultural sector at the provincial level. Finally, I will try to reconstruct two ‘model’ farms, which are more or less representative of the two

different macro-regions that can be distinguished. On the basis of micro-data from Zeeland and the eastern part of the country I will analyse relative levels of productivity in both model farms.

#### A matrix of farming systems

The farming systems of the Low Countries can broadly be classified in two ways: by the quality of the land they use (the basic distinction is between clay and sand) and by the man/land ratio of the region involved. Those parts of the country close to the sea, and often recovered (recently) on the sea, and those parts of the country in the delta of the great rivers (Rhine, Meuse, Scheldt), had relatively fertile clay soils, which by their nature tended to produce relatively high yields. In between the clay regions were large stretches of peat, which were colonized since the 10<sup>th</sup>/11<sup>th</sup> century; these soils were less productive and less suitable for arable farming, as a result of which these regions (mainly in Holland, Utrecht and Friesland) specialized on livestock farming, and had been able to attain relatively high levels of productivity as a result.

The sandy soils in the eastern and southern parts of the Netherlands, and in neighbouring Flanders, were much less fertile by their nature, and needed a much larger input of fertilizer to produce high yields. The line that runs from the south-west to the north-east that divides the Netherlands in two parts – below and above the sea level – divides these two regions.

Matrix of the agricultural systems of the Netherlands (including Flanders)

	Clay	Peat	Sand
High population density	Zeeland	South-Holland	Flanders
Middle population density		North-Holland	North-Brabant, Limburg (Overijssel, Gelderland)
Low population density	Groningen	Friesland	Drenthe

The second gradient was the land/man ratio, which tended to decrease from the north to the south: the countryside of the northern provinces were relatively sparsely populated, whereas population pressure in North-Brabant, Limburg, Zeeland, and in particular in neighbouring Flanders was extremely high. For 1812 we can estimate this land/man ratio, which varied from about 8 (ha per worker) in the three northern provinces (Friesland, Groningen and Drenthe) to about 2 in Flanders, whereas the other provinces tended towards the middle of the spectrum (Limburg 3.3, North-Brabant 4.0, Overijssel and Gelderland 5.5, North-Holland 6.1, South-Holland 5.9). Historically, high population pressure was linked to a high level of urbanization and close and old ties between cities and countryside; for Flanders those ties went back to the florescence of the Flemish economy during the Middle Ages, when it was the most urbanized region of the Low Countries. In the 15<sup>th</sup> century Holland had caught up with Flanders in this respect, but the northern and eastern part of the Netherlands remained less urbanized, and were still relatively ‘underpopulated’ at the beginning of the 19<sup>th</sup> century.

A first impression of the degree of regional variation can be derived from a comparison of two extreme cases, Drenthe and Flanders (the details on different farming systems are derived

from the sources of table 1) (see for example Bieleman 1987, for Drenthe, and Dehongh and Thoen 1999 for Flanders). In Drenthe a rather one-sided farming system existed, in which only two main crops – rye and buckwheat – were cultivated in a very extensive way (for example broadcast sowing and almost no weeding), which produced relatively low yields (12-15 hl per ha). In Flanders, the other extreme case, rye and wheat were intermixed with very labour intensive cash crops such as flax and potatoes (flax also supplied a lot of on-farm employment in the form of the further processing of the flax through spinning, weaving etc.). Clover was grown a lot in Flanders (often after flax), but not at all in Drenthe. In Flanders much manure was bought from the cities and other fertilizers (such as ashes) were imported from Holland; in Drenthe the manure came from the livestock which was herded on the extensive commons (the so called infield-outfield-system). Flemish yields were much higher, and attained levels which were more or less normal in the clay regions (20 to 25 hl per ha for rye and wheat). In the other sandy provinces, literally between Flanders and Drenthe, the farming system held the middle between the both extremes, dependent, again, to a large extent on the relative man/land ratio in the region. In parts of Brabant, for example, which was close to Flanders, the intensive ‘Vlaamse bouw’ was practiced, but in Overijssel and Gelderland yields were almost as low as in Drenthe.

Similar differences in farming systems can be found in the alluvial part of the country: at the beginning of the 19<sup>th</sup> century the northern province of Groningen specialized on labour extensive crops (oats, for example, and other grains), whereas labour intensive cash crops (flax, madder), and labour intensive ways to grow high-value grains (row cultivation with intensive weeding) dominated the agriculture of the southern province of Zeeland (and the southern rim of Holland) (see Priester 1991 and 1998).

#### Productivity of rye farming ca 1820

During the first third of the 19<sup>th</sup> century a new register of land and buildings (kadaster) was introduced in the Low Countries, modelled after the French example. In order to estimate the rental value of the land – which formed the basis for the land tax – detailed estimates of the output and the cost structure of arable farming were collected for all municipalities. These dossiers are a very valuable source of information on farming systems and associated levels of inputs and outputs, which have been used intensively by scholars working on different regions. I have collected a number of representative dossiers, covering the different farming systems of the sandy soils and the clay soils; it is possible to derive estimates of the net-yields of the different systems, and the amount of (male and female) labour that was used in growing the most important crops. In order to make the different dossiers comparable, I have concentrated on the cultivation of rye, and converted all information into the yield in rye (making use of the relative prices mentioned in the dossiers), and in the amount of male labour applied per ha (the female labour is converted into ‘male units’ on the basis of the relative wage of women versus men - about 60%). The details have been published in another paper.

Table 1 presents the results for five different communities on the sandy soils. When we concentrate on the extreme cases of Drenthe and Flanders again, it shows that the much higher population density in Flanders resulted in a doubling of the labour input per ha in rye farming (in other crops the labour input was even much higher, up to 160 mandays per ha for potatoes), and a simultaneous doubling of the net yield per ha. The increase in labour input is not evenly spread over the different parts of the agricultural cycle, however: the input of weeding increases from zero to 14 man-days (which are in effect 23 working days of women, times the relative wage of 60%), and the input of manuring and ploughing (often done in

combination) also increases relatively strongly. This result is consistent with the detailed research of Goossens into these dossiers. She concluded that (apart from soil type) two factors determined the relative yield per ha in Belgian agriculture: weeding and the purchase of manure from outside the farm (which was done on a large scale in Flanders); her estimates imply that an increase in the number of ways weeding by 10%, increased the yield of rye by about 1.1% (Goossens 1997: 270, 379).

This kind of information can therefore supply an answer to the question what happened to labour productivity (in European agriculture) when population pressure increased. The pessimistic, Malthusian interpretation that this must have led to a decline in labour productivity, seems to be unfounded, as labour productivity in Flanders is not lower than in Drenthe or Brabant. But the (optimistic) interpretation based on new-growth theory, which states that population increase will lead to increases in productivity (the result of either economies of scale, the lowering of transaction costs, or the creation and diffusion of knowledge) also appears to be only part of the truth. The factors that caused labour productivity to decline (less land per worker) seem to be balanced by factors that caused labour productivity to increase, and the net effect was that labour productivity in Drenthe (and in other provinces) was on par with that in Flanders.

Table 1 Productivity of different farming systems on sandy soils

	Drenthe (Rolde)	Holland (Laren)	Brabant (Rucphen)	Brabant (Made en Dimmelen)	Flanders (Laerne)
Net yield (hl rye per ha)	11	19	15	20	21
Labour input per ha (in man days):	5	5	5	7	15
Ploughing					
Sowing	1	1	1	1	1
Weeding*	0	9	8	13	14
Manuring	6	15	9	9	9
Mowing and binding*	6	6	9	17	10
Transport	2	5	4	3	4
Threshing	16	28	21	12	17
Total labour input	35	67	56	62	70
Labour productivity (in liters per day)	<b>.30</b>	<b>.28</b>	<b>.27</b>	<b>.33</b>	<b>.30</b>

\*Weeding and binding were female activities, which have been converted in man-days by multiplying the number of days by .6 (the relative wage of women compared to men)

Sources: a detailed analysis of these sources is presented Goossens and Dejongh (1997) and in Van Zanden (1994a); the Flemish data were kindly provided to me by prof. Juul Hannes; see Hannes (1994).

Table 2 Productivity of different farming systems on clay/peat soils

	Groningen	Groningen	Holland	Holland (Enkhuizen)
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	(Loppersum)	(Abbekerk)	(Wieringerwaard)	
Net yield (hl rye per ha)	20	22	27	32
Labour input per ha (in man days):	6	6	13	5
Ploughing				
Sowing	1	1	1	3
Weeding*	8	6	19	32
Manuring	2	3	2	3
Mowing and binding*	6	11	8	17
Transport	2	3	2	-
Threshing	24	16	19	17
Total labour input	48	45	64	77
Labour productivity (in liters per day)	<b>.42</b>	<b>.48</b>	<b>.41</b>	<b>.42</b>

\*Weeding and binding were female activities, which have been converted in man-days by multiplying the number of days by .6 (the relative wage of women compared to men)

Sources: a detailed analysis of these sources is presented Goossens and Dejongh (1997) and in Van Zanden (1994a).

A slightly different picture emerges when similar estimates of the labour input and the net yield of rye are compared for the clay/peat region. Crop yields are substantially higher in this region, whereas the labour input per ha is more or less comparable; as a result, labour productivity is at least one third higher than on the sandy soils. What is particularly striking is that much less labour is invested in manuring – one of the most labour intensive parts of the cropping cycle on the sandy soils. But there are also similarities: average yields per day worked are more or less the same in regions of extensive and of intensive cultivation (unfortunately, we do not have comparable sources for Zeeland, the province with the highest yields and probably the highest labour input as well; the Enkhuizen farming system was also a very labour intensive system, however); again, weeding is the most ‘elastic’ activity, ranging from 8 man days in Loppersum to 36 man days in Enkhuizen.

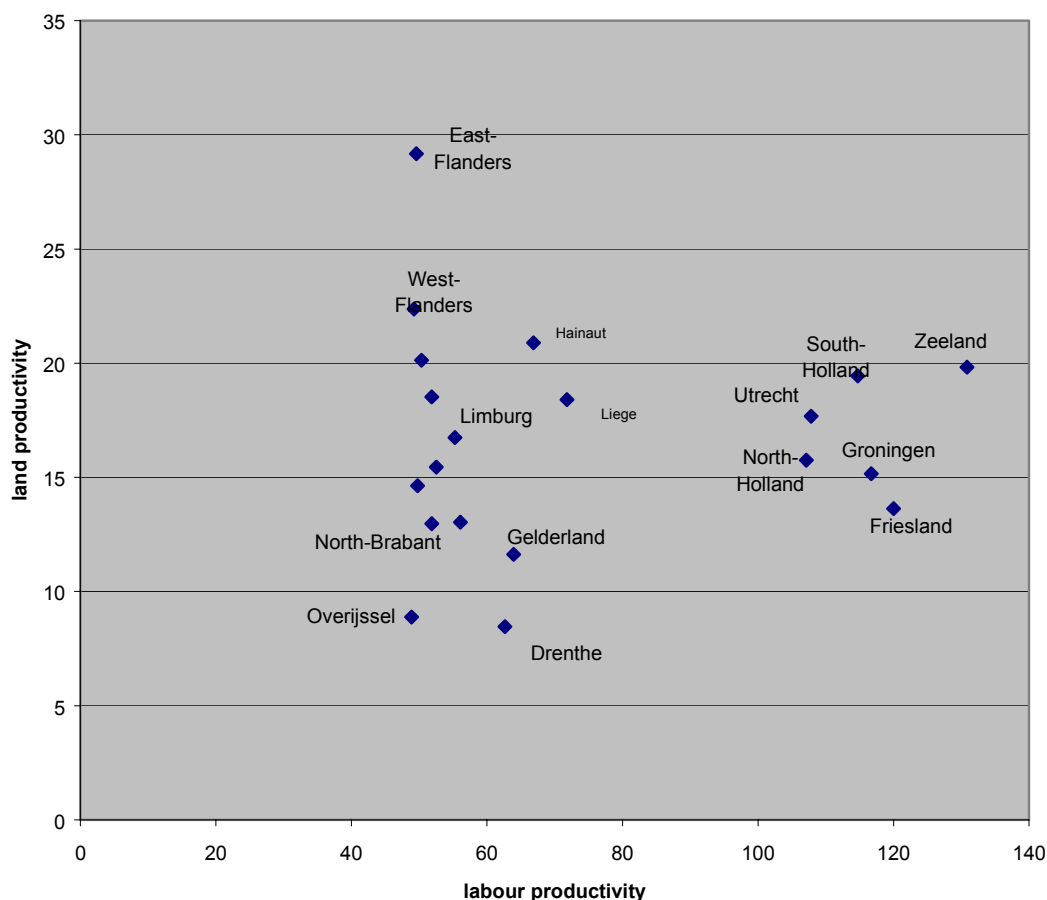
### Regional patterns in labour and land productivity

The disadvantage of the micro-data used in the previous section is that they cover only part of the agricultural sector. No comparable data are available for livestock farming, for example, and livestock contributed a substantial part of total value added in almost all regions (the exception is perhaps the highly specialized arable region of Zeeland). A number of studies have therefore tried to estimate the gross output and the value added of agriculture in the different provinces of the Low Countries at the beginning of the 19<sup>th</sup> century (1812 is the data of the first successful agricultural census by the French authorities, which forms the basis of

this research), and to relate these estimates to data on land, labour and livestock used (see Van Zanden 1985, Goossens 1993). It is possible to create one data base of the outputs and inputs of the 20 provinces of the Low Countries in 1812 on this basis (see Van Zanden 1994b); the estimates of all outputs are converted in hectolitres of rye using the relative prices of Belgium in 1812 (because the Belgian price data are more detailed than those from the Netherlands).

The results of this comparison are summarized in figure 1, which contains the estimates of land and labour productivity converted to hl liters per hectare and per man-year (i.e. gross output divided by the estimated land (in ha) and labour input (in man years)). The matrix of farming regions sketched in one of the previous sections emerges clearly from this comparison. In terms of labour productivity two macro-regions can be discerned: the clay and peat region of the coastal provinces of the Netherlands has a level of labour productivity of about 120 hl (equivalent to 0.5 hl per man day assuming about 250 working days per year), which is about twice as high as labour productivity on the sandy soils, where it ranges from 50 to 65 hl annually (or .20 to .25 hl per day) (the two provinces which have slightly higher levels of labour productivity, Hainaut and Liege, have loamy soils of a somewhat better quality than the sandy soils of the rim from Flanders to Drenthe; this part of Belgium is not considered in the rest of this paper however). Within the sandy-soils region the differences in levels of land productivity stand out clearly, with East-Flanders, close to a staggering 30 hl per ha, heading the league, and Drenthe/Overijssel, with a level of less than 10 hl, at its bottom. The level of labour productivity is not affected by these large differences in land productivity, however, a point already made in the previous section. (small point: because the gross output – including seed and feed - is estimated, differences in terms of value added per ha and per man year between the regions may have been somewhat smaller, because the more ‘advanced’ regions used more purchased inputs).

**Figure 1 Labour productivity and land productivity in the 20 provinces of the Low Countries in 1812 (in hl rye per ha and per man-year)**



The addition of estimates of the size and composition of the livestock does not change this picture a lot. The livestock density per ha did not vary much in the different regions of the Low Countries (it was close to one livestock unit per ha in all but a few provinces, the most notable exception being Zeeland where it was much lower, only .6 per ha). Attempts to estimate total factor productivity show that Eastern Flanders had a level of total productivity close to that of the coastal provinces of the Netherlands (i.e. they more or less shared the same ‘productivity frontier’, although Zeeland remains to some extent an ‘outlier’, beyond the frontier of the other coastal provinces). Total productivity in the eastern and southern parts of the country was much lower than in the coastal provinces, but this was not related to lower livestock densities. Sometimes it is suggested that livestock density is a proxy for the capital intensity of agriculture, and perhaps for the efficiency of the capital market (i.e. a low livestock density may point to a shortage of capital due to poorly developed capital markets). The available literature suggests however that capital markets in all parts of the country were developed quite well, and that almost all farmers had access to credit at relatively low interest rates - 5% appear to have been the norm both in the coastal districts and in the eastern and southern parts of the country (Trompeter (2001) has for example shown how extensive the rural capital market was in Twente, a district of the province of Overijssel, where farmers had easy access to a almost abundant supply of credit from local entrepreneurs). The large

disparities in labour and total productivity are therefore not related to different structures of the rural capital market.

## Two farm models

A number of studies make it possible to reconstruct two model farms, one on the sandy soils of North-Brabant (based on the detailed reconstruction of such a model farm by a contemporary author, S. van der Graaf (1807)), a region with relatively high yields (compared to Drenthe and Overijssel) and a rather high population density, and the other in the southern part of Holland (in the polders of the Beijerlanden), reconstructed by Baars (1973) on the basis of painstaking research into a.o. accounting books of actual farms.

The main features of both representative farms are:

- in Brabant: 4 ha arable land, and 1 ha of pasture (total size: 5 ha); livestock: 5 cows, 1 horse, and two pigs; labour input: two family members, one permanent helper, and some additional wage labour;
- in Southern-Holland: 50 ha arable (of which 15 ha in clover and temporary pasture) and 5 ha permanent pasture (total size 55 ha); livestock: 8 work horses and 6 young horses, 5 cows, 5 calves; labour input: two family members, four permanent helpers, and the equivalent of two man year in additional wage labour.

The difference in size is the most obvious contrast between the two farms: the model farm in the Beijerlanden is (in terms of acreage) eleven times as big as the Brabant farm, but the labour input is only about three times as large (when the labour input between these two farms is compared, it is important to notice that the Brabant farmers earned about f 100 with wage activities outside the own farm, which represents about one man-year, so the net labour input of the Brabant farm was about 2.13 man year). Other striking differences are the disparities in the level of wages - wages in Brabant are about half wages in Holland - and in rents/the value of land - the land price in Brabant is evaluated at fl 250 per ha, in Holland at fl 1100 per ha. The net effect is that wages formed a much smaller part of value added in Holland than in Brabant (in the latter farm the total wage sum - excluding the wage spend outside the farm - was more than 3.5 times as large as the total rent of the farm, whereas in Holland wages were only about 53% of total rents!). These estimates imply however that the capital invested per ha was higher in Brabant than in Holland (which also applies to the livestock density, which was much higher on the small farm).

When these estimates are converted in hl rye (the standard of the estimates presented in the two previous sections) a familiar picture emerges: the net yield per ha was about the same in the two model farms (18.5 hl in Holland, 22 hl in Brabant), but the net output per man year was striking: 52 hl per man year, or .2 hl per day worked in Brabant, and 128 hl per man year, or .5 hl per day worked in Holland. It is clear that the extremely high labour productivity on the Holland model farm is not the result of high land productivity, but of the fact that Holland farmers were able to produce comparable yields with much less labour. Part of the difference is probably related to the size of the farms (i.e. the fact that average farms in the coastal provinces were much larger than on the sandy soils), part is also related to the better quality of the land. As large farms dominated in the coastal provinces, and small farms on the sandy soils, it is extremely difficult to determine what caused what. Clay soils, for example, needed much and heavy ploughing, and the normal plough team consisted of 4 to 6 horses (and a very expensive plough). On the much lighter sandy soils one horse could already do the job (although in some regions two horses were preferred). The minimum threshold of a viable farm on the clay soils was therefore much higher than on the sandy soils, where very holdings predominated. During the Early Modern Period the average size of holdings tended

to increase in the coastal provinces – in particular in the regions of arable farming; in the dairy districts of Holland and Frisia farms remained smaller on average – whereas on the sandy soils average holdings declined substantially – both in terms of land and in terms of livestock (i.e. number of horses or cattle per farm). The sharp contrasts that are evident at the beginning of the 19<sup>th</sup> century are therefore the result of diverging trends during the preceding centuries (in the 16<sup>th</sup> century average holdings in parts of Holland were probably smaller than in Brabant or Overijssel).

A final point that can be made concerns the balance of incomes and expenditure. The years between 1790 and 1815 were characterized by extremely high grain prices, as a result of which the net incomes of farmers increased substantially (because rents lagged behind the rise in prices: see for example Baars (1973: 201) for Holland and Van Zanden (2001) for Overijssel). The relatively large incomes earned by the farmers are therefore rather exceptional for this period, although Holland farmers were in general rather well off in the 18<sup>th</sup> and 19<sup>th</sup> centuries (they, for example, lived in large farmsteads, and their material culture was well developed).

#### Model farm in Brabant, ca 1805

Income:	
3 ha of rye * 18 hl = 54 hl @ f 5.33	F 288
1 ha potatoes 100 hl potatoes @ f 1.50	150
4 cows produce 275 kg butter @ f .45	124
Sale of one cow (f 45), 4 calves (f 20), 2 pigs (150 kg pork @ f.30)	110
Income from farm	F 672
Net labour income from other activities (peat digging, wood cultivation)	100
Total income	F 772
Costs: wage labour one helper (f 50 wage and f 50 board and lodging)	F 100
Wage labour two members household	F 200
Additional wage labour during harvest	F 13
Feed and seed (15 hl rye @ f 5.33 plus 34 hl oats @ f 2.65)	F 178
Purchase 2 pigs (f 6), and salt for butter making (f 20)	F 26
Interest and depreciation instruments, livestock and buildings (f 600 @ 10%)	F 60
Rent of land/Interest on capital invested in land (f 250 * 5 @ 5%)	F 63
Direct taxes	F 25
Total costs	F 665
Net income farmer	F 107

Source: Van der Graaf 1807.

#### Model farm in South-Holland (Beijerlanden) ca 1810

Income:	
11 ha wheat * 20 hl @ f 10.88	F 2394
4 ha barley * 30 hl @ f 5.35	F 642
4 ha oats * 32 hl @ f 3.43	F 439
4 ha beans * 22 hl @ f 6.78	F 597
4 ha oilseed rape * 20 hl @ f 14.60	F 1168
4 ha flax * 11 hl linseed and 535 kg fiber	F 800
4 ha potatoes 200 hl @ 1.75	F 1400

Sale of 1.5 horses on average annually @ f 110	F 165
Butter 255 kg @ f .73	F 186
Meat 600 kg @ f .30	F 180
Total income	F 7971
Wages labourers ca. 6 manyears	F 1200
Wages two family members	F 400
Seed and feed ( 22 hl wheat, 8 hl barley, 40 hl potatoes, all beans and oats, clover and coleseed)	F 1236
Salt	F 20
Interest and depreciation of implements, livestock, buildings (f 3700 @ 10%)	F 370
Direct taxes	F 440
Rent/interest on capital invested in land (f 1100 * 55 ha @ 5%)	F 3025
Total costs	F 6691
Profit income farmer	F 1180

Source: Baars (1973) pp. 186-201; additional data from model farms in neighbouring Zeeland from Priester (1999) and prices from Van Zanden (1985)

### Output and consumption

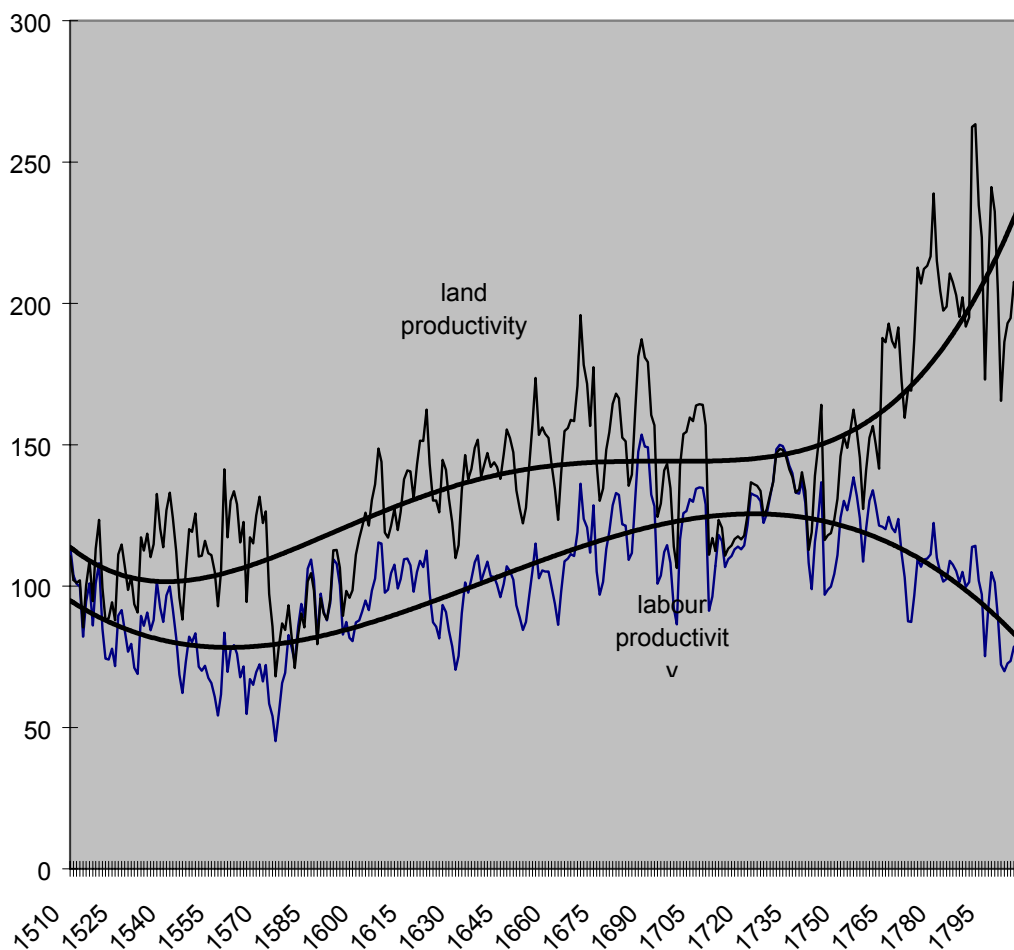
The different levels of labour productivity in the coastal provinces versus the land provinces were also related to different structures of the economy. The per capita consumption of foodstuffs can roughly be estimated at about 8 hl of rye equivalents (3 hl for cereals and potatoes, 3 to 4 hl for meat, butter, cheese etc, and 1 hl for other products, such as flax, wool, and oil seeds). The share of the labour force in total population was about 40%, which implies that one man-year is more or less equivalent to 2.5 consumption units (or, in order to reproduce and maintain one man year, 2.5 people years were necessary). Total per 'man-year' consumption can thus be estimated at 20 hl. A net output of 50 hl (in rye equivalents) on the sandy soils is consistent with a share of agriculture in the labour force of about 40% (or one family in agriculture can feed 1.5 families outside it); in practice this share was slightly higher, at about 50%, in 1807 (Horlings 1995: 333). In the coastal provinces this share is much lower: a net output of about 100 hl of rye means that the share of agriculture in the labour force can in theory be as low as c. 25% (or one person/family in agriculture can feed 3 persons/families outside it); again, in practice it was somewhat higher at about one-third in 1807 (probably both regions were about self-sufficient on balance, as exports were more or less equal to imports; and this was certainly the case on a national level).

### Developments between 1500 and 1800

Changes in the level of productivity during the preceding centuries can only be sketched very roughly, because data are much scarcer and only a few studies have tried to estimate the long term development of agricultural productivity in a systematic way. The most detailed estimates can be derived from on-going research into the 'regional' historical national accounts of Holland between 1510 and 1807 (see Van Zanden 2002 for the first results of this project) (see figure 2). In the long run labour productivity did not increase at all during the Early Modern Period (in fact, production per day worked fell, and the number of working days per annum increased from about 200 to about 250), whereas output per ha increased

rather strongly in periods of growing population pressure (in particular between 1580 and 1670), but remained more or less the same in the period when population growth came to a halt (after 1670).

**Figure 2 The long term development of labour productivity and land productivity in the agricultural sector of Holland (indices 1510/14=100)**



Holland is probably more or less representative for trends elsewhere, in particular in the coastal region. A recent survey by Van Bavel (1999) of long run developments in yields argued that not much increase in them could be found between the late Middle Ages and the beginning of the 19<sup>th</sup> century; the increase in land productivity that occurred was mainly due to the growing of more cash crops with a relatively high value (and a comparable high labour input per ha) (see also Priester 1999). In Holland (and the other coastal provinces) the improvements in drainage resulting from a.o. the spread of windmills and other innovations in water drainage may have contributed to the increase in land productivity, however. For the land provinces increases in yields per ha and yield ratios are relatively well documented; in Overijssel/Drenthe the yield ratio of rye increased from about 3 in the 16<sup>th</sup> and early 17<sup>th</sup> century to about 5 in the beginning of the 19<sup>th</sup> century; at the same time, the farming system

became more intensive and more geared to the growing of cereals (instead of livestock farming) (see Bieleman 1987).

Trends in labour productivity are even more difficult to measure, but again the case of Holland seems to be rather representative of developments elsewhere. An important fact is that nominal wages of agricultural labourers increased much less than grain prices, as a result of which farmers were induced to apply more labour per ha. If the conclusions based on a comparison between the different agricultural regions at the beginning of the 19<sup>th</sup> century are correct, this Boserupian growth (i.e. the adoption of more labour intensive cropping systems) will have led to a stabilization of labour productivity. One way to test this idea of to focus on certain parts of the agricultural cycle for which price wages are available; by comparing these piece wages (i.e. the wage for a certain amount of threshing, reaping or mowing) with the daily wages of agricultural labourers (during the same season) estimates of the labour productivity of those activities can be made (see Clark (1991) for an application of this idea). In Holland and Zeeland, for which relatively good data are available, I found no trend in labour productivity between the late Middle Ages and the early 19<sup>th</sup> century (the wage data were taken from Priester 1998, De Moor 2000, and Van Zanden 1994a), which suggests that there were no major improvement in labour productivity in those parts of the agricultural cycle (on closer inspection of the British data I could also not find any evidence for an increase in labour productivity there too, a result which still puzzles me as it appears to be in conflict with the results published Clark 1991; perhaps at some stage this kind of evidence should be examined more closely by scholars working on the topic of agricultural productivity). In their detailed study of agricultural productivity in Flanders Dejongh and Thoen also found a more or less stationary level of labour productivity in this region during the Early Modern Period, whereas land productivity went up substantially during this period (Dejongh and Thoen 1999). This suggests that the regional structure of labour productivity present at the beginning of the 19<sup>th</sup> century already dates from the (late) Middle Ages.

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