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VOLUME MEASUREMENT OF GOVERNMENT OUTPUT IN THE NETHERLANDS; SOME ALTERNATIVES

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Summary

This paper deals with the measurement of the production volume of government. Three alternative methods are described. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker euqivalent. The implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

Contents

1. Introduction

The yearly Dutch National Accounts publication contains a chapter on the explanation of the accounts. In the accounts of 1988 (CBS, 1989), the following statement is made:

"In the government sector, production per full-time worker equivalent is almost constant, because of the conventions applied and the deflators used. Gross output value is not based on a market value, but equals the sum of the value of its inputs (gross value added and intermediate consumption). The gross value added at factor costs is equal to the consumption of fixed capital plus compensation of employees. The deflator of gross value added is computed from the price change of these components. As a consequence, a change in the production per full-time worker equivalent can only occur if the deflator of the consumption of fixed capital strongly deviates from the change in the wage rate or if the shares of both components in total gross value added change a lot. Such a change does not have an economic interpretation."

This paper deals with the measurement of the production volume of government. Three alternative methods are described. They have in common that they result in estimates for production per full-time worker equivalent which are not necessarily (almost) constant. Therefore, parts of this paper focus on the impact of the described methods on estimates of government labour productivity.

According to the System of National Accounts (SNA), gross value added at factor costs of the government equals the sum of the consumption of fixed capital, wages and national insurance contributions (United Nations, 1968). In most countries, no imputations are made for changes in labour productivity, although some countries do (OECD, 1987). In addition to adjustments for labour productivity change due to changes in the skill composition of labour force, the statistical bureaus in Norway and Germany assume an autonomous annual labour productivity growth of the government of 0.5 percent. Also in Luxembourg an autonomous increase of 0,5 percent is assumed. In Belgium, an extra increase in productivity is estimated from the size of periodic pay adjustments which government employees receive to keep their salaries in line with those of

comparable workers in the business sector; half of the periodic adjustments are assumed to compensate for increased labour productivity. In Italy changes in labour productivity are conducted from measures of work-load, absenteeism and office automation. The adjustments in Italy usually varies between 0.3 and 0.5 percent per annum.

In this paper we use a rather narrow definition of the sector 'government' (CBS, 1986). Here, the sector government includes the activities public administration (including the financial-economic policy), jurisdiction, police and defense, social security, state-supervision, public health and education, but excludes the management of hospitals and a number of (semi-)public enterprises like the Postal and Telegraph Service, and the Public Railroad Services.

In the literature, one method for measuring the production volume of the sector government dominates: the 'output indicator method'. According to this method, government is split up into several subsectors. Then, for each subsector an indicator for output is estimated. Examples of such indicators are the number of fires extinguished, number of crimes resolved and the number of people on social benefits. An indicator of labour productivity is conducted as the quotient of the approximated production and the number of working years involved. This method is in conformity with the recommendations in the SNA (Hill and Franz, 1976).

An example of the 'output indicator method' is a research carried out at the Bureau of Labor Statistics of the U.S. Department of Labor (1988). The Bureau of Labor Statistics divided total government into 28 functional units. For each unit, many activities were distinguished and per activity sometimes one, but more often several output indicators were computed. A complete description of the units, activities and indicators distinguished covers almost 350 pages. The data are conducted from a survey at about 400 organizations in around 60 agencies, covering circa 70 percent of 2.1 million total federal civilian years (Kendrick, 1989). Another example, a research in Sweden, is described in Fastbom (1989).

The research of the Bureau of Labor Statistics resulted in the availability of a large and detailed data set. This data set can be used, not only for estimating the production volume and labour productivity per unit, but also for management purposes and budgeting. However, in most countries one does not have such a data set, because its construction is very elaborate and very expensive. Therefore, most researchers of the labour productivity of government restrict themselves to the data available. The same restriction applies to the research described in this paper. Section 2 presents an estimate of the labour productivity of the sector 'government' in the Netherlands, based on the 'output indicator method'.

In addition to the 'output indicator method', an econometric method to estimate the labour productivity of government is developed. It is assumed that the total output of a sector can be modelled as a Cobb-Douglas production function. By dividing both sides of the equation with the sectoral labour input, we get a Cobb-Douglas labour productivity function. Further it is assumed that the parameters in the Cobb-Douglas labour productivity function are sector-independent. If this assumption holds, the labour productivity function can be estimated from data on non-government sectors. Next, government labour productivity is deduced by filling in the estimated function. Finally, changes in the net production volume of government can be computed as the sum of changes in labour input volume and changes in labour productivity.

In section 3 the practicability of this 'structural determinants method' is investigated. It appears that, with the presently available data, this rather elegant method does not lead to fully reliable estimates of the labour productivity of government. Not all parameters are sector-independent. However, the growth rates of government labour productivity which can be deduced, are of the same order of magnitude as the estimates according to the other methods described in this paper.

Section 4 presents a third method to estimate the production volume of the government[1]. Currently, the output of government in constant prices, needed to compute labour productivity, is derived by deflating the inputs. Over 90 percent of the inputs consists of compensation of employees. Therefore, the overall price deflator of government production is almost equal to the price

deflator of labour inputs. Currently, the change in this deflator equals the average wage rate change. Consequently the production volume change of government almost equals the increase in the number of civil servants. In turn, this results in a nearly zero labour productivity change. A similar method to estimate the production volume of government is used in e.g. the United States, Australia, Sweden and the United Kingdom. The 'deflator method', worked out in section 4, introduces an alternative deflator for the labour inputs: the index of contractual wage rates. A similar deflator is used in e.g. Belgium, Canada, Japan, France, Germany and Norway.

The main conclusions of this paper are summarized in section 5. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker euqivalent. Further, the implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

Finally, it is emphasized that 'productivity' is not the same as 'effectivity'. Productivity applies to efficiency, i.e. the relation between means and realized production while effectivity applies to the relation between means and contemplated production. Production has something to do with "*doing things the right way*", effectivity tells us something about "*getting the right things to be done*" (Fastbom, 1989).

2. The output indicator method

2.1 Introduction

Detailed time series on government production and numbers of civil servants in the Netherlands hardly exist. Therefore it was decided to start with the data published by the Netherlands Social and Cultural Planning Bureau (SCP) in 'Trendrapport Kwartaire Sector 1970 - 1993' [Report on trends in the public sector 1970 -1993] (Blank, Kuhny, Van Puijenbroek, Ruitenberg and Van Tulder, 1989). This SCP-report presents detailed data on consumption of public goods and services, the labour force involved, and costs of production in several fields in 1970, 1975, 1980 and 1986. The data on labour inputs are measured in full-time worker equivalents of 1986, which compensates for annual fluctuations in the number of working-hours per full-time worker equivalent.[2]

The estimates of consumption of public goods and services are used here as indicators of government production. In general, this assumption seems reasonable and therefore the SCP-indicator is replaced only if it is obvious that this assumption does not hold and another indicator is easy to construct. However, the choice of a proper indicator is always somewhat arbitrary. Our own indicators have been used for the subsectors 'education and science' and 'general administration'.

Four subsectors are distinguished: (1) education and science, (2) public order and security, (3) taxes and social security, and (4) general administration. These four subsectors cover the sector government as a whole (according to the narrow definition of the sector government), except defense. The latter has been excluded from this part of the analysis, for a generally acceptable output indicator does not yet exist.

Again, each subsector is divided into sub-subsectors. The sub-subsectors for which labourforce-estimates are available and for which one ore more output indicators exist account for over 60 percent of total government (defense excluded). The SCP-estimates of the labour force and the output indicators are based on CBS-statistics, governmental reports and annual reports of the treasury. Details on these data can be found in appendix 1.

2.2 Output indicators

Education and science

Blank and others (1989) used the number of students as demand indicator in the subsector education and science. For the purpose of their research this undoubtedly is a suitable indicator. Yet, as an indicator of production it is inadequate[3]. In fact, consumers of education do not intend to buy a number of hours of education but intend to buy an increase in knowledge. In this respect, Goudriaan, Van Tulder, Blank, Van der Torre and Kuhny (1989) proposed a better indicator: the number of successfully completed school-years. However, the construction of a time series of this indicator is rather cumbersome. Therefore a simpler indicator was chosen: the number of students that successfully completed education. For the time being, the question to what extent this indicator is affected by quality changes and changes in the system of education, remains unanswered.

The production indicator, mentioned above, is not equally relevant for all types of education; especially not for primary education. Since the age of compulsory attendance at school is 15, almost everyone has completed primary school. Therefore, one should use another indicator for this type of education.[4] Further, the necessary data on adult education are not available. For the current research, these types of education were not taken into account.

Public order and security

In the SCP-report the subsector 'public order and security' is divided into four sub-subsectors: police, fire services, jurisdiction and the penology-system. Indicators of the production of the police are the number of traffic accidents with personal injury, the number of records of violent offences, and the number of records of other non-indictable offences[5]. These three indicators are weighted with the amount of time involved in 1986. The production indicator of the fire services is the number of assistances. The production of the subsubsector 'jurisdiction' is measured as the sum of fifteen different types of civil, criminal and administrative cases. The product of the number of

inmates in the institutions and the average number of days per inmate is used as an indicator of the production of the penology-system. Here these SCP-indicators are used as output-indicator.

Taxes and social security

For the treasury the SCP selected twelve indicators, such as the number of tax-returns, the number of P.A.Y.E.-forms en the number of returns for the sales tax. The demand for social security benefits was considered as the production indicator of social security: the number of receivers of a social benefit regarding the labour disablement insurances, the medical expenses insurance, old age insurance, unemployment insurances, the National Assistance Act, the Social Unemployment Provisions Act, etc. Here these indicators are used as output-indicators.

General administration

It is rather difficult to find an adequate production indicator of general administration. The subsector 'general administration' produces, for example, the administration of public property, legislation, and policy. For none of these, proper indicators exist. For lack of a more direct method, the sum of the final consumption and the consumption of fixed capital (in constant prices) of the government is used.

2.3 Estimates

The estimates of labour productivity in each of the (sub-)subsectors are presented in table 1. They must be interpreted with care. Especially the choice of output indicators can be improved. The indicators used are often partial and they do not always measure government production in a strict sense. For example, university research is not taken into account. Another example: the main task of the police is not to register traffic accidents and police warrants, but to prevent traffic accidents and offences, and to fight crime (e.g. Levitt, 1989). Therefore the estimates per (sub-)subsector are sometimes debatable. Nevertheless, the overall estimate of the trends in the labour

productivity seem reasonable: a slight decrease in the first half of the seventies, followed by an average annual increase of about one percent till 1986. During the whole period, 1970 - 1986, the average annual increase equalled about half a percent.

Table 1. Labour productivity of the sector government, index-numbers 1986 = 100

	1970	1975	1980	1986	Average annual change
					%
Education and science					
- secondary education	72	88	92	100	2.1
- primary and secondary vocational training	87	43	105	100	0.9
- tertiary vocational education	88	94	99	100	0.8
- university	47	50	54	100	4.8
total	75	67	91	100	1.8
Public order and security					
- police	117	97	92	100	-1.0
- fire-brigade	84	75	85	100	1.1
- jurisdiction	126	129	126	100	-1.4
- penology-system	85	82	84	100	1.0
total	112	98	94	100	-0.7
Taxes and social security					
- tax authority	81	80	93	100	1.3
- employment bureaus	14	49	51	100	13.1
- industrial insurance boards	84	95	104	100	1.1
- municipal social services	45	95	66	100	5.1
- boards of labour	83	90	90	100	1.2
- social unemployment relief	100	83	100	100	0.0
total	75	86	90	100	1.8
General administration	98	99	95	100	0.1
Total government	90	88	93	100	0.7

3. The structural determinants method

3.1 General

Instead of using direct measurable indicators of government production volume, one can also apply a more or less indirect method. Let's assume that the production process of almost all sectors in the economy can be modelled as a Cobb-Douglas production function. A general form of the Cobb-Douglas production function is

$$Q_{it} = A\, K_{it}^{\alpha}\, L_{it}^{\beta} \quad (i = 1...I;\ t = 1...T) \tag{1}$$

with Q_{it} representing constant price value added, A a constant factor and K_{it} and L_{it} being the amount of inputs of an **abstract** capital stock equivalent and an **abstract** labourforce equivalent in sector i and year t. If required, one may add more factors, e.g. entrepreneurship. The constant A and the coefficients α and β are assumed to be time- and sector-independent. The sum of α and β not necessarily equals one, allowing for non-constant returns to scale.

In general, total capital stock consists of a large number of different types of capital stock, which all contribute to total production, although not all to the same extent. We therefore introduced the abstract capital stock equivalent (see e.g. Sevestre (1990) for a similar approach), which can be modelled as a function of the actual total volume of capital stock ($\mathbf{K}_{it}$) and some its characteristics (y_{imt}):

$$K_{it} = \mathbf{K}_{it} * e^{f(y_{imt} \mid m = 1...M)} \quad (i = 1...I;\ t = 1...T). \tag{2}$$

Some relevant characteristics are the shares and average age of the different types of capital: means of transport, buildings, and equipment.

Similarly, the abstract labour input equivalent can be modelled as a function of the actual total labour input ($\mathbf{L}_{it}$) and some if its characteristics (z_{int}) like the sex-ratio, the average age of the employees, the average level of education, the share of handworkers and the average number of working-hours:

$$L_{it} = \mathbf{L}_{it} * e^{g(z_{int} \mid n = 1...N)} \qquad (i = 1...I;\ t = 1...T). \tag{3}$$

The reduced form of this model can be obtained by combining equations (1) to (3):

$$Q_{it} = A * \left[\mathbf{K}_{it} * e^{f(y_{imt} \mid m = 1...M)} \right]^{\alpha} * \left[\mathbf{L}_{it} * e^{g(z_{int} \mid n = 1...N)} \right]^{\beta} \qquad (i = 1...I,\ t = 1...T). \tag{4}$$

By dividing both sides of equation (4) with $\mathbf{L}_{it}$ we get a Cobb-Douglas labour productivity function. Taking the logarithm, this Cobb-Douglas labour productivity function can be written as

$$\log(Q_{it} / \mathbf{L}_{it}) = \log(A) + \alpha \log(\mathbf{K}_{it}/\mathbf{L}_{it}) + \alpha f(y_{imt} \mid m = 1...M) + (\alpha + \beta - 1) \log(\mathbf{L}_{it}) + \beta g(z_{int} \mid n = 1...N) \qquad (i = 1...I;\ t = 1...T). \tag{5}$$

The first step is to estimate equation (5), using data on non-government sectors. Next the hypothesis of sector-independent coefficients is tested. Finally, if the first and second step yield satisfying results, the labour productivity of government can be approximated by filling in the estimated labour productivity function.

3.2 Data

To employ the 'structural determinants method', one needs data on both production and structural determinants; preferably of similar industries and as detailed as possible. Unfortunately, the estimates of the production volume in the service industries are rather weak and not very reliable. This applies, for example, to the sectors Banking and Insurance and Social services. Therefore, data on less similar industries were used. However, industries with structural determinants of weight which clearly do not apply to the government, were excluded; for example the sector 'Agriculture'. The production of the sector

'agriculture' heavily depends on the weather, which is a determinant that hardly affects the production of government. For a similar reason the sector 'Public utility' was not included in the analysis.

There are not many statistics on capital stock and either they are not very detailed or the time series are rather short. Therefore, unpublished data were used, which are normally used to estimate the National accounts estimates on investment and consumption of fixed capital. These data allow to distinguish between three types of capital stock: buildings and civil engineering works, transport equipment, and machinery and other equipment. These data are also used to derive an indicator of the average age or the recency of the capital stock: the sum of the investments of the last three years divided by total capital stock.

Data on determinants of labour input were extracted from the biennial statistics on labourforce (AKT). These statistics provide data on the composition of labour inputs: sex-ratio, average age, average working-hours per week, educational attainment and the shares of different occupation groups like professional, technical and related workers, administrative and managerial workers and production and related workers.

Other determinants that might affect production are the degree of computerization, employee absenteeism and probably the average number of days that employees are involved in strikes. Unfortunately, data on these determinants lack the necessary detail or the time series are too short or have too many missing observations. Further, strikes are relatively rare in the Netherlands, and therefore not very relevant. A complete list of sectors distinguished and details on the construction of the determinants can be found in appendix 2.

3.3 Estimates

Using the data available, the following The Cobb-Douglas labour productivity function was estimated:

$$\begin{aligned}\log(Q_{ij}/L_{it}) = {} & \log(A) + \alpha \log(K_{it}/L_{it}) \\ & + \alpha [\, \tau_1 \text{ MACHINES}_{it} + \tau_2 \text{ BUILDINGS}_{it} + \tau_3 \text{ RECENCY}_{it} + \tau_4 \,] \\ & + (\alpha + \beta - 1) \log(L_{it}) \\ & + \beta [\, \tau_5 \log(\text{AGE}_{it}) + \tau_6 \log(\text{TIME}_{it}) + \tau_7 \log(\text{EDUCATION}_{it}) \\ & \quad + \tau_8 \text{ GENDER}_{it} + \tau_9 \text{ ADMIN}_{it} + \tau_{10} \text{ PROD}_{it} + \tau_{11} \,] \\ & \quad (i = 1...I;\ t = 1...T).\end{aligned} \tag{6}$$

Q/L	- Labour productivity; 1000 glds (in prices of 1980) per full-time worker equivalent
K/L	- Capital intensity; 1000 glds (in prices of 1980) per full-time worker equivalent
MACHINES	- Share of machinery and other equipment in total capital stock
BUILDINGS	- Share of buildings and civil engineering works
RECENCY	- Sum of last 3 years investment divided by total capital stock
L	- Number of workers (1000 full-time worker equivalents)
AGE	- Average age
TIME	- Average working-time (hours per week)
EDUCATION	- Average level of education (years of education)
GENDER	- Share of female labour input
ADMIN	- Share of professional, technical and related workers, and administrative and managerial workers in total labour input
PROD	- Share of production and related workers, transport equipment operators and labourers in total labour input

Total capital stock was divided into three groups. Because of model-identification, only two of these groups could be included in the equation. For a similar reason the share of professional, technical and related workers was not included. The same applies to the share of male labour input. The regression results are:

$$\log(Q_{ij}/L_{it}) = \underset{(-2.3)}{-7.5} + \underset{(5.9)}{0.14}\ \log(K_{it}/L_{it}) + \underset{(3.1)}{0.25}\ MACHINES_{it}$$

$$- \underset{(-2.6)}{0.35}\ BUILDINGS_{it} + \underset{(3.8)}{1.3}\ RECENCY_{it} + \underset{(0.31)}{0.0054}\ \log(L_{it})$$

$$+ \underset{(5.4)}{3.0}\ \log(AGE_{it}) - \underset{(-2.2)}{1.1}\ \log(TIME_{it}) + \underset{(4.3)}{1.9}\ \log(EDUCATION_{it})$$

$$- \underset{(-0.0035)}{0.0052}\ GENDER_{it} - \underset{(-3.6)}{1.9}\ ADMIN_{it} + \underset{(1.5)}{0.23}\ PROD_{it}.$$

$R^2 = 0.83$; Adjusted $R^2 = 0.82$; N = 140; t-values between brackets.

The regression results are quite good. Most parameters have the expected sign and differ from 0 at a significance level of 5 percent. The share of female workers does not affect labour productivity. Further, the results suggest constant returns to scale, according to the almost zero and insignificant coefficient of $\log(L_{it})$.

The time series are too short to test the hypothesis of sector-independent coefficients for all coefficients simultaneously. Therefore this hypothesis was tested for each coefficient at a time. These tests led to the conclusion that at least the constant is sector-dependent. Therefore one may not rule out the possibility that one or more important structural determinants were not included in the analysis, or worse, that the changes in labour productivity are sector-dependent. Therefore, extrapolating the regression results to the sector government does not necessarily yield reliable results. If one does, the approximated labour productivity of government is (index numbers, 1980 = 100):

1979	1980	1981	1982	1983	1984	1985
99.8	100.0	100.1	101.4	102.7	105.4	108.2

4. The deflator method

As already mentioned, the production of government per full-time worker equivalent is almost constant, because of the methods applied and the deflators used. In fact, one can approximate gross value added of government at constant base-year prices by multiplying the wage bill in the base year with the increase in the number of civil servants. The amount of indirect taxes paid by the government and the consumption of fixed capital are relatively low, and changes in the size of these components hardly affect the production volume of government.

Consequently, it is implicitly assumed that changes in the wage rate of civil servants equals the price change of government services. In reality, this is not the case. If *labour income and wages in the service sector tend to follow labour productivity* (Kendrick, 1985)[6], this might also be true for the government. Wage rate changes can then be split up into at least two components: compensation for inflation and compensation for productivity changes. A proxy for the first component is the index of basic wage rates according to collective agreements (CAO-wages). Here, this latter index is used as an alternative deflator to calculate the production volume of government.[7]

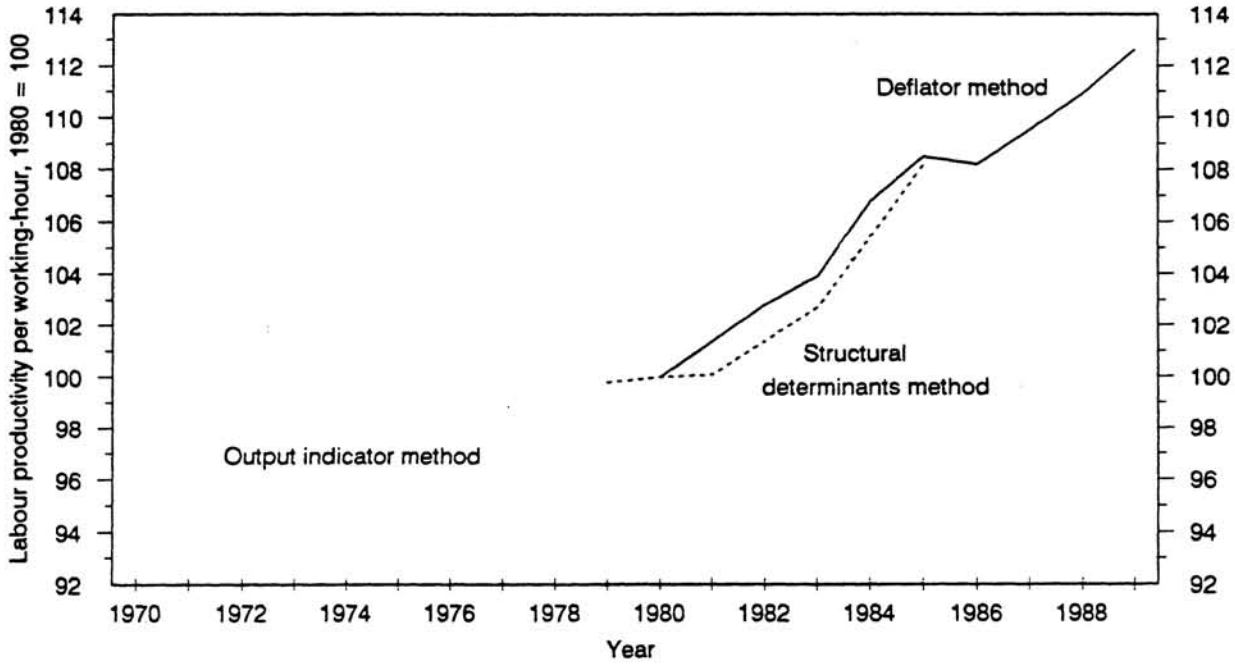
Two different indexes of CAO-wages are available: the index numbers of CAO-wages per hour and the index numbers of CAO-wages per week and per month. The former is preferred here, because this index neutralizes the effects of a reduction in the collectively agreed number of working-hours. Whereas a reduction in working-hours, which in fact amounts to an increase of labour costs, does not affect the index of CAO-wages per week or per month, it does affect the index per hour. Therefore the index of CAO-wages per hour is used to deflate total compensation of employees (gross wages and salaries, and social charges) such that chances in charges in social security premiums will affect the output price of government services and not output volume. This results in the following series of index numbers (1980 = 100) of labour productivity of government:

1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
100.0	101.4	102.8	103.9	106.8	108.5	108.2	109.5	110.9	112.6

5. Conclusions

In this paper three different methods were used to estimate changes of the labour productivity of the government. All methods led to similar results, summarized in figure 1: an average yearly labour productivity increase per working-hour of about 1.3 percent since 1980. As since then, the number of working-hours per full-time worker equivalent has fallen at an average rate of 0.6 percent per annum, there remains an average 0.7 percent increase of labour productivity per full-time worker equivalent.

Figure 1. Labour productivity of government



The results of the 'output indicator method' show an slight decrease in labour productivity from 1970 till 1976, followed by an increase from 1976 till 1986. Although the results per (sub-)subsector should be interpreted with considerable care, the overall average trend seems rather plausible. Further research in this area should focus on better output indicators and more complete time series.

The 'structural determinants method' yielded promising, but not (yet) directly applicable results. Most parameters were significant at a 5 percent level and had the expected sign. However, there is some evidence that not all

parameters are fully sector-independent. This means that probably an important part of the sectoral variation was not explained. However, the approximated government labour productivity changes are plausible and of the same order of magnitude as the other methods' estimates.

In contrast to the methods mentioned above, the 'deflator method' does not use direct or indirect measurable indicators of government production. Instead, it assumes a causal relation between part of the wage rate changes and changes in labour productivity. Nevertheless, the assumptions are plausible, the method is simple and it is easy to implement in the current National accounts compilation process. Table 2 presents the alternative estimates of gross value added.

Table 2. Alternative estimates of gross value added[a]

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	annual change
Gross value added in constant prices (market prices)	index numbers, 1980 = 100										%
National economy											
- current NA	100.0	99.7	98.3	99.6	103.2	106.3	108.0	109.3	112.3	116.6	1.5
- alternative	100.0	99.9	98.8	100.1	104.0	107.1	108.5	110.0	113.2	117.7	1.6
Government											
- current NA	100.0	101.9	102.2	101.8	102.0	103.1	104.0	104.8	104.5	104.5	0.4
- alternative	100.0	103.4	105.3	105.3	107.0	108.6	107.6	109.4	110.4	111.7	1.1

a) These figures cannot be compared with those presented elsewhere in this paper, because in the current National accounts the number of working-hours per full-time worker equivalent is not constant.

Similar 'deflator method' methods are presently used in e.g. Belgium, Canada, Japan, France, Germany and Norway. If this method had also been applied in the Netherlands, the annual change of GDP at constant prices in the Netherlands would have been 0.1 percentage point higher. This equals almost half of the difference in economic growth between the Netherlands and Germany[8] during this period. For the government, it would have led to an increase in the growth rate of 0.7 percentage points.

The average annual labour productivity (per full-time worker equivalent) increase of 0.7 percent almost equals the increase in labour productivity in the business services in the Netherlands.

Appendix 1. Data used for the 'output indicator method'

	1986	1970	1975	1980	1986
	labour volume	index-numbers 1986 = 100			
labour force					
Education and science					
- secondary education	44000	83	99	111	100
- primary and secondary vocational education	43000	70	82	92	100
- tertiary vocational education	17500	52	71	93	100
- university	21000	77	98	102	100
Public order and security					
- police	40428	66	80	95	100
- fire-brigade	4013	70	89	102	100
- jurisdiction	6150	54	62	81	100
- penology-system	5351	62	68	85	100
Taxes and social security					
- tax authority	31657	73	87	94	100
- employment bureaus	3553	71	75	90	100
- industrial insurance boards	20700	57	78	92	100
- municipal social services	14160	58	65	87	100
- boards of labour	3881	90	91	97	100
- social unemployment relief	7830	56	87	94	100
General administration	213000	84	89	102	100
Production indicators					
Education and science					
- secondary education		60	87	102	100
- primary and secondary vocational education		61	35	97	100
- tertiary vocational education		46	67	92	100
- university		36	49	55	100
Public order and security					
- police		77	78	87	100
- fire-brigades		59	67	87	100
- jurisdiction		68	80	102	100
- penology-system		53	56	71	100
Taxes and social security					
- tax authority		59	70	87	100
- employment bureaus		10	37	46	100
- industrial insurance boards		48	74	96	100
- municipal social services		26	62	57	100
- boards of labour		75	82	87	100
- social unemployment relief		56	72	94	100
General administration		82	88	97	100

Appendix 2. The construction of data for the 'structural determinants method'[9]

To employ the 'structural' determinants method, one needs data of as many sectors as possible. However, the National accounts estimates of production volume are sometimes rather weak. Therefore, not all sectors were included in the analysis. Further, some sectors were excluded because of missing data on determinants. Table A2.1 presents a lists of sectors of which reliable data on production volume (and labour productivity), and on the determinants distinguished, were available.

Table A2.1. List of sectors of which data was used for the 'structural determinants method'

Classes/groups of economic activities	Description
20, 21	Food, beverage and tobacco industry
22	Textile industry
23	Clothing industry
24	Leather, footware and other leatherware (excl. clothing) industry
25	Wood and furniture industry (excl. metal furniture)
26	Paper and paper products industry
27	Printing, publishing and related industry
28	Petroleum industry
29, 30	Chemical processing industry
31	Rubber and plastic-processing industry
32	Manufacture of building materials, earthenware, glass and glass products
33	Basic metal industry
34	Manufacture of metal products
35	Machinery
36	Electrotechnical industry
37	Automobile industry and manufacture of transport equipment
38, 39	Manufacture of instruments and optical goods and other industry
5	Construction and installation on construction projects
61-68	Trade, hotels, restaurants, cafes, etc.
71, 72, 74-77	Other transport storage and communication
73, 75	Sea and air transport

The labour productivity per sector is calculated as the quotient of the gross value added at factor costs in constant prices and the total labour force. Data on labour force per sector can be found in the Dutch national accounts. However, the number of working-hours per full-time worker equivalent changes each year. The corrections, to get constant full-time worker equivalents, can were derived from Bos (1987). Data on gross value added are not published in the required detail, but are obtainable on request. The determinants of capital input are all derived from unpublished data, which are normally used to estimate the consumption of fixed capital.

Data on determinants of labour input are all derived from the biennial statistics on labourforce (AKT). The AKT presents, among other, data on numbers of workers per characteristic per sector of activity. Relevant characteristics are age, working-hours per week, level of education, gender and the shares of various occupational groups. The statistics for age and working-hours are published in classes, and the statistics for education are published according to levels of education, which could be transformed to an approximated number of years of education to reach that level. The average age, working-hours and level of education are calculated as the weighted means of class- or level-middles. As the AKT is a biennial statistic, published in the uneven years from 1979 to 1985, the missing years had to be interpolated. Data on the shares of different types of occupational groups in 1979 were not available. Therefore it was assumed that the shares did not change between 1979 and 1981.

Notes

1) I thank Symon Algera, who provided me with the basic ideas of this method.
2) In the Netherlands National accounts, total employment is measured in full-time worker equivalents of the current year. The number of working-hours per full-time worker equivalent slightly decreases. Therefore, estimates of the labour productivity deduced from the national accounts, are slightly underestimated.
3) An estimate of the labour productivity, based upon the number of students, is very sensitive to small changes in, for example, the statutory minimal size of a classgroup or changes in the age of compulsory attendance at school (Hjerppe, 1980). Such changes undeniably affect the work-load of teachers, but it can be doubted whether they also affect labour productivity.
4) An alternative production indicator for primary education might be the number of pupils that continues study, weighted with the level of the continued education.
5) Levitt (1989) considers prevention as the main product of the police. However, prevention is a rather abstract concept and hard to measure. Levitt attempts to estimate it, using an econometric model.
6) This proposition of Kendrick was countered by Baumol (1985) and Hulten (1985) in their comments on Kendrick's paper.
7) In general, changes in CAO-wages are partly meant to compensate for increased labour productivity. Therefore, the CAO-wage rate changes, as a proxy for price changes of government services, overestimate the latter. On the other hand, one may question if the difference between the actual wage-rage changes and the CAO-wage rate changes is only caused by changes in labour productivity.
8) The remaining half of the gap between economic growth rates of the Netherlands and Germany can be almost fully explained by the German assumption of an autonomous 0.5 percent annual labour productivity growth in government services.
9) The data are available on request.

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National Accounts Occasional Papers

NA/01 Flexibility in the system of National Accounts, Van Eck, R., C.N. Gorter and H.K. van Tuinen (1983).
This paper sets out some of the main ideas of what gradually developed into the Dutch view on the fourth revision of the SNA. In particular it focuses on the validity and even desirability of the inclusion of a number of carefully chosen alternative definitions in the "Blue Book", and the organization of a flexible system starting from a core that is easier to understand than the 1968 SNA.

NA/02 The unobserved economy and the National Accounts in the Netherlands, a sensitivity analysis, Broesterhuizen, G.A.A.M. (1983).
This paper studies the influence of fraud on macro-economic statistics, especially GDP. The term "fraud" is used as meaning unreporting or underreporting income (e.g. to the tax authorities). The conclusion of the analysis of growth figures is that a bias in the growth of GDP of more than 0.5% is very unlikely.

NA/03 Secondary activities and the National Accounts: Aspects of the Dutch measurement practice and its effects on the unofficial economy, Van Eck, R. (1985).
In the process of estimating national product and other variables in the National Accounts a number of methods is used to obtain initial estimates for each economic activity. These methods are described and for each method various possibilities for distortion are considered.

NA/04 Comparability of input-output tables in time, Al, P.G. and G.A.A.M. Broesterhuizen (1985).
It is argued that the comparability in time of statistics, and input-output tables in particular, can be filled in in various ways. The way in which it is filled depends on the structure and object of the statistics concerned. In this respect it is important to differentiate between coordinated input-output tables, in which groups of units (industries) are divided into rows and columns, and analytical input-output tables, in which the rows and columns refer to homogeneous activities.

NA/05 The use of chain indices for deflating the National Accounts, Al, P.G., B.M. Balk, S. de Boer and G.P. den Bakker (1985).
This paper is devoted to the problem of deflating National Accounts and input-output tables. This problem is approached from the theoretical as well as from the practical side. Although the theoretical argument favors the use of chained Vartia-I indices, the current practice of compilating National Accounts restricts to using chained Paasche and Laspeyres indices. Various possible objections to the use of chained indices are discussed and rejected.

NA/06 Revision of the system of National Accounts: the case for flexibility, Van Bochove, C.A. and H.K. van Tuinen (1985).
It is argued that the structure of the SNA should be made more flexible. This can be achieved by means of a system of a general purpose core supplemented with special modules. This core is a fully fledged, detailed system of National Accounts with a greater institutional content than the present SNA and a more elaborate description of the economy at the meso-level. The modules are more analytic and reflect special purposes and specific theoretical views.

NA/07 Integration of input-output tables and sector accounts; a possible solution, Van den Bos, C. (1985).
The establishment-enterprise problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation. An adapted sectoring of institutional units is proposed for the construction of input-output tables.

NA/08 A note on Dutch National Accounting data 1900-1984, Van Bochove, C.A. (1985).
This note provides a brief survey of Dutch national accounting data for 1900-1984, concentrating on national income. It indicates where these data can be found and what the major discontinuities are. The note concludes that estimates of the level of national income may contain inaccuracies; that its growth rate is measured accurately for the period since 1948; and that the real income growth rate series for 1900-1984 may contain a systematic bias.

NA/09 The structure of the next SNA: review of the basic options, Van Bochove, C.A. and A.M. Bloem (1985).
There are two basic issues with respect to the structure of the next version of the UN System of National Accounts. The first is its 'size': reviewing this issue, it can be concluded that the next SNA should contain an integrated meso-economic statistical system. It is essential that the next SNA contains an institutional system without the imputations and attributions that pollute the present SNA. This can be achieved by distinguishing, in the central system of the next SNA, a core (the institutional system), a standard module for non-market production and a standard module describing attributed income and consumption of the household sector.

NA/10 Dual sectoring in National Accounts, Al, P.G. (1985).
Following a conceptual explanation of dual sectoring, an outline is given of a statistical system with complete dual sectoring in which the linkages are also defined and worked out. It is shown that the SNA 1968 is incomplete and obscure with respect to the links between the two sub-processes.

NA/11 Backward and forward linkages with an application to the Dutch agro-industrial complex, Harthoorn, R. (1985).
Some industries induce production in other industries. An elegant method is developed for calculating forward and backward linkages avoiding double counting. For 1981 these methods have been applied to determine the influence of Dutch agriculture in the Dutch economy in terms of value added and labour force.

NA/12 Production chains, Harthoorn, R. (1986).
This paper introduces the notion of production chains as a measure of the hierarchy of industries in the production process. Production chains are sequences of transformation of products by successive industries. It is possible to calculate forward transformations as well as backward ones.

NA/13 The simultaneous compilation of current price and deflated input-output tables, De Boer, S. and G.A.A.M. Broesterhuizen (1986).
A few years ago the method of compiling input-output tables underwent in the Netherlands an essential revision. The most significant improvement is that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.

NA/14 A proposal for the synoptic structure of the next SNA, Al, P.G. and C.A. van Bochove (1986).

NA/15 Features of the hidden economy in the Netherlands, Van Eck, R. and B. Kazemier (1986).
This paper presents survey results on the size and structure of the hidden labour market in the Netherlands.

NA/16 Uncovering hidden income distributions: the Dutch approach, Van Bochove, C.A. (1987).

NA/17 Main national accounting series 1900-1986, Van Bochove, C.A. and T.A. Huitker (1987).
The main national accounting series for the Netherlands, 1900-1986, are provided, along with a brief explanation.

NA/18 The Dutch economy, 1921-1939 and 1969-1985. A comparison based on revised macro-economic data for the interwar period, Den Bakker, G.P., T.A. Huitker and C.A. van Bochove (1987).
A set of macro-economic time series for the Netherlands 1921-1939 is presented. The new series differ considerably from the data that had been published before. They are also more comprehensive, more detailed, and conceptually consistent with the modern National Accounts. The macro-economic developments that are shown by the new series are discussed. It turns out that the traditional economic-historical view of the Dutch economy has to be reversed.

NA/19 Constant wealth national income: accounting for war damage with an application to the Netherlands, 1940-1945, Van Bochove, C.A. and W. van Sorge (1987).

NA/20 The micro-meso-macro linkage for business in an SNA-compatible system of economic statistics, Van Bochove, C.A. (1987).

NA/21 Micro-macro link for government, Bloem, A.M. (1987).
This paper describes the way the link between the statistics on government finance and national accounts is provided for in the Dutch government finance statistics.

NA/22 Some extensions of the static open Leontief model, Harthoorn, R.(1987).
The results of input-output analysis are invariant for a transformation of the system of units. Such transformation can be used to derive the Leontief price model, for forecasting input-output tables and for the calculation of cumulative factor costs. Finally the series expansion of the Leontief inverse is used to describe how certain economic processes are spread out over time.

NA/23 Compilation of household sector accounts in the Netherlands National Accounts, Van der Laan, P. (1987).
This paper provides a concise description of the way in which household sector accounts are compiled within the Netherlands National Accounts. Special attention is paid to differences with the recommendations in the United Nations System of National Accounts (SNA).

NA/24 On the adjustment of tables with Lagrange multipliers, Harthoorn, R. and J. van Dalen (1987).
An efficient variant of the Lagrange method is given, which uses no more computer time and central memory then the widely used RAS method. Also some special cases are discussed: the adjustment of row sums and column sums, additional restraints, mutual connections between tables and three dimensional tables.

NA/25 The methodology of the Dutch system of quarterly accounts, Janssen, R.J.A. and S.B. Algera (1988).
In this paper a description is given of the Dutch system of quarterly national accounts. The backbone of the method is the compilation of a quarterly input-output table by integrating short-term economic statistics.

NA/26 Imputations and re-routeings in the National Accounts, Gorter, Cor N. (1988).
Starting out from a definition of 'actual' transactions an inventory of all imputations and re-routeings in the SNA is made. It is discussed which of those should be retained in the core of a flexible system of National Accounts. Conceptual and practical questions of presentation are brought up. Numerical examples are given.

NA/27 Registration of trade in services and market valuation of imports and exports in the National Accounts, Bos, Frits (1988).
The registration of external trade transactions in the main tables of the National Accounts should be based on invoice value; this is not only conceptually very attractive, but also suitable for data collection purposes.

NA/28 The institutional sector classification, Van den Bos, C. (1988).
A background paper on the conceptual side of the grouping of financing units. A limited number of criteria are formulated.

NA/29 The concept of (transactor-)units in the National Accounts and in the basic system of economic statistics, Bloem, Adriaan M. (1989).
Units in legal-administrative reality are often not suitable as statistical units in describing economic processes. Some transformation of legal-administrative units into economic statistical units is needed. This paper examines this transformation and furnishes definitions of economic statistical units. Proper definitions are especially important because of the forthcoming revision of the SNA.

NA/30 Regional income concepts, Bloem, Adriaan M. and Bas De Vet (1989).
In this paper, the conceptual and statistical problems involved in the regionalization of national accounting variables are discussed. Examples are the regionalization of Gross Domestic Product, Gross National Income, Disposable National Income and Total Income of the Population.

NA/31 **The use of tendency surveys in extrapolating National Accounts**, Oudde-ken, Frank and Gerrit Zijlmans (1989).
This paper discusses the feasibility of the use of tendency survey data in the compilation of very timely Quarterly Accounts. Some preliminary estimates of relations between tendency survey data and regular Quarterly Accounts-indicators are also presented.

NA/32 **An economic core system and the socio-economic accounts module for the Netherlands**, Gorter, Cor N. and Paul van der Laan (1989).
A discussion of the core and various types of modules in an overall system of economy related statistics. Special attention is paid to the Dutch Socio-economic Accounts. Tables and figures for the Netherlands are added.

NA/33 **A systems view on concepts of income in the National Accounts**, Bos, Frits (1989).
In this paper, concepts of income are explicitly linked to the purposes of use and to actual circumstances. Main choices in defining income are presented in a general system. The National Accounts is a multi-purpose framework. It should therefore contain several concepts of income, e.g. differing with respect to the production boundary. Furthermore, concepts of national income do not necessarily constitute an aggregation of income at a micro-level.

NA/34 **How to treat borrowing and leasing in the next SNA**, Keuning, Steven J. (1990).
The use of services related to borrowing money, leasing capital goods, and renting land should not be considered as intermediate inputs into specific production processes. It is argued that the way of recording the use of financial services in the present SNA should remain largely intact.

NA/35 **A summary description of sources and methods used in compiling the final estimates of Dutch National Income 1986**, Gorter, Cor N. and others (1990).
Translation of the inventory report submitted to the GNP Management Committee of the European Communities.

NA/36 **The registration of processing in make and use tables and input-output tables**, Bloem, Adriaan M., Sake De Boer and Pieter Wind (1990, forthcoming).
The registration of processing is discussed primarily with regard to its effects on input-output-type tables and input-output quotes. Links between National Accounts and basic statistics, user demands and international guidelines are examined.

NA/37 **A proposal for a SAM which fits into the next System of National Accounts**, Keuning, Steven J. (1990).
This paper shows that all flow accounts which may become part of the next System of National Accounts can be embedded easily in a Social Accounting Matrix (SAM). In fact, for many purposes a SAM format may be preferred to the traditional T-accounts for the institutional sectors, since it allows for more flexibility in selecting relevant classifications and valuation principles.

NA/38 **Net versus gross National Income**, Bos, Frits (1990).
In practice, gross figures of Domestic Product, National Product and National Income are most often preferred to net figures. In this paper, this practice is challenged. Conceptual issues and the reliability of capital consumption estimates are discussed.

NA/39 **Concealed interest income of households in the Netherlands; 1977, 1979 and 1981**, Kazemier, Brugt (1990).
The major problem in estimating the size of hidden income is that total income, reported plus unreported, is unknown. However, this is not the case with total interest income of households in the Netherlands. This makes it possible to estimate at least the order of magnitude of this part of hidden income. In this paper it will be shown that in 1977, 1979 and 1981 almost 50% of total interest received by households was concealed.

NA/40 **Who came off worst: Structural change of Dutch value added and employ-- ment during the interwar period**, Den Bakker, Gert P. and Jan de Gijt (1990).
In this paper new data for the interwar period are presented. The distribution of value added over industries and a break-down of value added into components is given. Employment by industry is estimated as well. Moreover, structural changes during the interwar years and in the more recent past are juxtaposed.

NA/41 **The supply of hidden labour in the Netherlands: a model**, Kazemier, Brugt and Rob van Eck (1990).
This paper presents a model of the supply of hidden labour in the Netherlands. Model simulations show that the supply of hidden labour is not very sensitive to cyclical fluctuations. A tax exempt of 1500 guilders for second jobs and a higher probability of detection, however, may substantially decrease the magnitude of the hidden labour market.

NA/42 **Benefits from productivity growth and the distribution of income**, Keuning, Steven J. (1990).
This paper contains a discussion on the measurement of multifactor productivity and sketches a framework for analyzing the relation between productivity changes and changes in the average factor remuneration rate by industry. Subsequently, the effects on the average wage rate by labour category and the household primary income distribution are studied.

NA/43 **Valuation principles in supply and use tables and in the sectoral accounts**, Keuning, Steven J. (1991).
In many instances, the valuation of transactions in goods and services in the national accounts poses a problem. The main reason is that the price paid by the purchaser deviates from the price received by the producers. The paper discusses these problems and demonstrates that different valuations should be used in the supply and use tables and in the sectoral accounts.

NA/44 **The choice of index number formulae and weights in the National Accounts. A sensitivity analysis based on macro-economic data for the interwar period**, Bakker, Gert P. den (1991).
The sensitivity of growth estimates to variations in index number formulae and weighting procedures is discussed. The calculations concern the macro-economic variables for the interwar period in the Netherlands. It appears, that the use of different formulae and weights yields large differences in growth rates. Comparisons of Gross Domestic Product growth rates among countries are presently obscured by the use of different deflation methods. There exists an urgent need for standardization of deflation methods at the international level.

NA/45 **Volume measurement of government output in the Netherlands; some alternatives**, Kazemier, Brugt (1991).
This paper discusses three alternative methods for the measurement of the production volume of government. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker equivalent. The implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

NA/46 **An environmental module and the complete system of national accounts**, Boo, Abram J. De, Peter R. Bosch, Cor N. Gorter and Steven J. Keuning (1991).
A linkage between environmental data and the National Accounts is often limited to the production accounts. This paper argues that the consequences of economic actions on ecosystems and vice versa should be considered in terms of the complete System of National Accounts (SNA). One should begin with relating volume flows of environmental matter to the standard economic accounts. For this purpose, a so-called National Acccounting Matrix including Environmental Accounts (NAMEA) is proposed. This is illustrated with an example.

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