NETHERLANDS CENTRAL BUREAU OF STATISTICS

Department of National Accounts, Research Division
428 Prinses Beatrixlaan
2273 XZ Voorburg
The Netherlands

VOLUME MEASUREMENT OF GOVERNMENT OUTPUT IN THE NETHERLANDS

some alternatives

Brugt Kazemier

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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 (UN, 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

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

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}):

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

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:

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

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

$$Q_{it} = A * \left[K_{it} * e^{f(y_{imt} \mid m = 1...M)} \right]^{\alpha} \tag{4}$$

$$* \left[L_{it} * e^{g(z_{int} \mid n = 1...N)} \right]^{\beta} \qquad (i = 1...I,\ t = 1...T).$$

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

$$\log(Q_{it} / L_{it}) = \log(A) + \alpha \log(K_{it}/L_{it}) + \alpha f(y_{imt} \mid m = 1...M) \tag{5}$$

$$+ (\alpha + \beta - 1) \log(L_{it}) + \beta g(z_{int} \mid n = 1...N)$$

$$(i = 1...I;\ t = 1...T).$$

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:

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

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:

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

$$- \underset{(-2.6)}{0.35}\ \text{BUILDINGS}_{it} + \underset{(3.8)}{1.3}\ \text{RECENCY}_{it} + \underset{(0.31)}{0.0054}\ \log(L_{it})$$

$$+ \underset{(5.4)}{3.0}\ \log(\text{AGE}_{it}) - \underset{(-2.2)}{1.1}\ \log(\text{TIME}_{it}) + \underset{(4.3)}{1.9}\ \log(\text{EDUCATION}_{it})$$

$$- \underset{(-0.0035)}{0.0052}\ \text{GENDER}_{it} - \underset{(-3.6)}{1.9}\ \text{ADMIN}_{it} + \underset{(1.5)}{0.23}\ \text{PROD}_{it}.$$

$R^2 = 0.83$; 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.

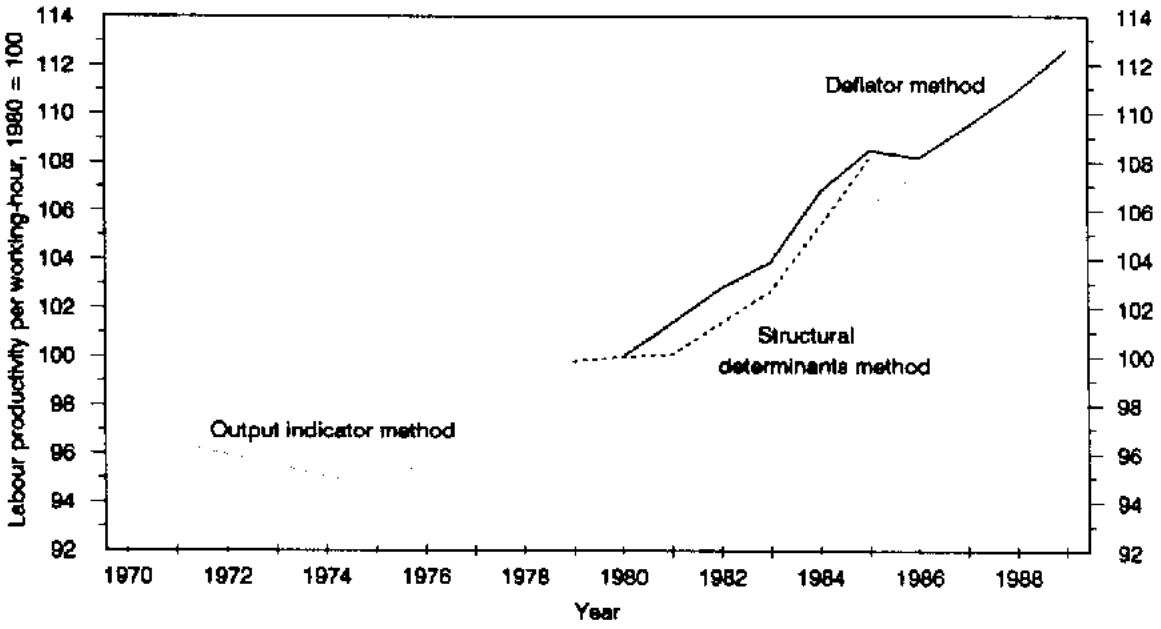

Figure 1. Labour productivity of government

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. This would have led to the following estimates of gross value added[8]:

	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	1.8
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

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[9] 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'[10]

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) 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.
9) 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.
10) The data are available on request.

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