

CHAPTER 5: GOVERNMENT SERVICES

Introduction

- 5.1. Government services are the services provided to households by general government. They comprise individual services and collective services. Individual services are the services that general government provides to specific identifiable households – that is, services, such as health and education, which benefit, or which are consumed by, individual households. Collective services are those that general government provides simultaneously to all members of the community – that is, services, such as police and fire protection, which benefit, or which are consumed by, households collectively.
- 5.2. “General government” is the term used in the SNA 93¹ and the ESA 95² to describe the institutional sector that consists of central, regional, state and local government units together with the social security funds controlled by these units. Non-profit institutions engaged in non-market production that are controlled and mainly financed by government units or social security funds are also included in the general government sector. Throughout this chapter “government” means “general government” unless specifically stated otherwise.
- 5.3. Government expenditure on government services is called “government final consumption expenditure” or “GFCE”. It is divided between two main aggregates in the Eurostat-OECD expenditure classification. Expenditures on individual services constitute *individual consumption expenditure by government*. Expenditures on collective services make up *collective consumption expenditure by government*. Both main aggregates are important in terms of their shares of GDP in EU Member States and OECD Member Countries. Individual consumption expenditure by government ranges from 5 to 19 per cent of GDP depending on the country, while collective consumption expenditure by government accounts for around 8 or 9 per cent of GDP in most countries.
- 5.4. Individual consumption expenditure by government is also important because it is one of three components of *actual individual consumption* – the other components being individual consumption expenditure by households and individual consumption expenditure by non-profit institutions serving households (NPISHs). Actual individual consumption is a measure of what households actually consume – rather than what they actually purchase – and as such it is of particular relevance to comparisons of economic welfare. Among EU Member States and OECD Member Countries, the contribution of individual consumption expenditure by government to actual individual consumption is significant. It is 12 per cent on average with a range of 8 to 27 per cent.
- 5.5. This chapter explains how PPPs for individual consumption expenditure by government and collective

consumption expenditure by government are obtained within the framework of a Eurostat-OECD comparison. It starts by defining the individual and collective services covered by these two main aggregates and continues by distinguishing between the services that government produces itself and the services that government purchases from market producers. This is followed by an outline of the basic methodology and a review of the reference PPPs that are used in the absence of prices. The chapter continues by describing the survey of compensation of employees which is the only price collection conducted specifically for the calculation of PPPs for government expenditure. It concludes with an annex on productivity adjustment which, as explained in the annex, is an important consideration when comparing GFCE across countries.

Individual and collective services

- 5.6. Individual and collective services are comprehensively defined in COFOG 98 and these are the definitions that are followed in the Eurostat-OECD expenditure classification. Broadly speaking, individual services are housing, health, recreation and culture, education and social protection; and collective services are general public services, defence, public order and safety, economic affairs, environment protection, and housing and community amenities. Box 5.1 gives a more precise definition in terms of COFOG groups. All the COFOG groups shaded in grey are collective services. They include the research and development (R&D) for individual services: R&D Health, R&D Education, etc. They include as well the overall policy-making, planning, regulatory, budgetary, co-ordinating and monitoring responsibilities of ministries overseeing individual services: Health n.e.c., Education n.e.c., etc. These activities, unlike the services to which they relate, cannot be identified with specific individual households and are considered to benefit households collectively.

Market and non-market services

- 5.7. Collective services are produced by government. Individual services can be produced by government and they can also be purchased by government from market producers. The mix varies from country to country. The individual services that government purchases from market producers are called “market services”. This is because they are sold at prices that are economically significant – that is, at prices that determine the amounts producers supply and purchasers buy. Being economically significant, the prices can be used to value the outputs of market producers by multiplying the quantities produced by the prices at which they are sold. The collective and individual services that government produces itself are referred to as “non-market services”. This is because they are supplied free or sold at prices that are not economically significant.³

5.8. The absence of economically-significant prices for non-market services means that it is not possible to value the outputs of non-market producers in the same way as the outputs of market producers are valued. Because of this, national accountants have adopted the convention of valuing the outputs of non-market producers by totalling up the costs to produce them. The value of the output of non-market producers is equal to the sum of their expenditures on the non-market services they produce or, if there have been sales, to the sum of their expenditures less the value of their sales. To maintain consistency with the prices underlying these expenditures, it is necessary to use the purchasers' prices

of inputs to calculate the PPPs for non-market services. This is called the "input-price approach".

Treatment of non-market services

5.9. The input-price approach requires a breakdown of the expenditure on non-market services by cost components. The basic cost components used in Eurostat-OECD comparisons are: compensation of employees, intermediate consumption, gross operating surplus, net taxes on production and receipts from sales. The breakdown is based on the assumption that the data will be taken from the gov-

Box 5.1: Collective services (CS) and individual services (IS)

COFOG 98 Groups	COFOG 98 Groups
<p>01. GENERAL PUBLIC SERVICES</p> <p>01.1 Executive & legislative organs, financial & fiscal affairs, external affairs (CS)</p> <p>01.2 Foreign economic aid (CS)</p> <p>01.3 General services (CS)</p> <p>01.4 Basic research (CS)</p> <p>01.5 R&D General public services (CS)</p> <p>01.6 General public services n.e.c. (CS)</p> <p>01.7 Public debt transactions (CS)</p> <p>01.8 Transfers of a general character between different levels of government (CS)</p> <p>02. DEFENCE</p> <p>02.1 Military defence (CS)</p> <p>02.2 Civil defence (CS)</p> <p>02.3 Foreign military aid (CS)</p> <p>02.4 R&D Defence (CS)</p> <p>02.5 Defence n.e.c. (CS)</p> <p>03. PUBLIC ORDER & SAFETY</p> <p>03.1 Police services (CS)</p> <p>03.2 Fire-protection services (CS)</p> <p>03.3 Law courts (CS)</p> <p>03.4 Prisons (CS)</p> <p>03.5 R&D Public order & safety (CS)</p> <p>03.6 Public order & safety n.e.c. (CS)</p> <p>04. ECONOMIC AFFAIRS</p> <p>04.1 General economic, commercial & labour affairs (CS)</p> <p>04.2 Agriculture, forestry, fishing & hunting (CS)</p> <p>04.3 Fuel & energy (CS)</p> <p>04.4 Mining, manufacturing & construction (CS)</p> <p>04.5 Transport (CS)</p> <p>04.6 Communication (CS)</p> <p>04.7 Other industries (CS)</p> <p>04.8 R&D Economic affairs (CS)</p> <p>04.9 Economic affairs n.e.c. (CS)</p> <p>05. ENVIRONMENT PROTECTION</p> <p>05.1 Waste management (CS)</p> <p>05.2 Waste water management (CS)</p> <p>05.3 Pollution abatement (CS)</p> <p>05.4 Protection of biodiversity & landscape (CS)</p> <p>05.5 R&D Environment protection (CS)</p> <p>05.6 Environment protection n.e.c. (CS)</p>	<p>06. HOUSING & COMMUNITY AMENITIES</p> <p>06.1 Housing development (CS)</p> <p>06.2 Community development (CS)</p> <p>06.3 Water supply (CS)</p> <p>06.4 Street lighting (CS)</p> <p>06.5 R&D Housing & community amenities (CS)</p> <p>06.6 Housing & community amenities n.e.c. (CS)</p> <p>07. HEALTH</p> <p>07.1 Medical products, appliances & equipment (IS)</p> <p>07.2 Out-patient services (IS)</p> <p>07.3 Hospital services (IS)</p> <p>07.4 Public health services (IS)</p> <p>07.5 R&D Health (CS)</p> <p>07.6 Health n.e.c. (CS)</p> <p>08. RECREATION, CULTURE & RELIGION</p> <p>08.1 Recreational & sporting services (IS)</p> <p>08.2 Cultural services (IS)</p> <p>08.3 Broadcasting & publishing services (CS)</p> <p>08.4 Religious & other community services (CS)</p> <p>08.5 R&D Recreation, culture & religion (CS)</p> <p>08.6 Recreation, culture & religion n.e.c. (CS)</p> <p>09. EDUCATION</p> <p>09.1 Pre-primary & primary education (IS)</p> <p>09.2 Secondary education (IS)</p> <p>09.3 Post-secondary non-tertiary education (IS)</p> <p>09.4 Tertiary education (IS)</p> <p>09.5 Education not definable by level (IS)</p> <p>09.6 Subsidiary services to education (IS)</p> <p>09.7 R&D Education (CS)</p> <p>09.8 Education n.e.c. (CS)</p> <p>10. SOCIAL PROTECTION</p> <p>10.1 Sickness & disability (IS)</p> <p>10.2 Old age (IS)</p> <p>10.3 Survivors (IS)</p> <p>10.4 Family & children (IS)</p> <p>10.5 Unemployment (IS)</p> <p>10.6 Housing (IS)⁽¹⁾</p> <p>10.7 Social exclusion n.e.c. (IS)</p> <p>10.8 R&D Social protection (CS)</p> <p>10.9 Social protection n.e.c. (CS)</p>

⁽¹⁾ In the Eurostat-OECD classification of final expenditure on GDP, housing is not included under social protection. Instead, both are identified as separate expenditure categories.

ernment production account. Receipts from sales is required to net off gross output to obtain government final consumption expenditure on the production of these services. Gross operating surplus and net taxes on production are included for completeness. In practice, gross operating surplus will be equal to consumption of fixed capital since net operating surplus is expected to be negligible. Box 5.2 shows that this cost structure has been introduced into the Eurostat-OECD expenditure classification only for the three most important services produced by government: health, education and collective services. PPPs for the remaining services - housing, recreation and culture, and social protection - are not derived through the input-price approach. Reference PPPs are used instead as explained below.

- 5.10. It can be seen from Box 5.2 that, while basic cost components - compensation of employees, intermediate consumption, gross operating surplus, net taxes on production and receipts on sales - are the same for health, education and collective services, different additional details, or refinements, have been introduced for all three services. For health, compensation of employees is broken down by whether the employee is medical staff or non-medical staff and intermediate consumption is broken down by type of product. For education, compensation of employees is broken down by the level of education being provided. For collective services, both compensation of employees and intermediate consumption are broken down by whether or not the service is related to defence.

Treatment of market services

- 5.11. Purchases of individual services from market producers by government are financed differently from country to country. The government may buy the services direct from the producers or it may reimburse households, either in full or in part, after the households themselves have made the purchase. Irrespective of the way the purchases are effected, application of the “who pays” principle of the SNA 93 and the ESA 95 means that all government expenditure on individual services purchased from market producers is recorded under government and that only the household expenditure on these purchases that is not reimbursed is included under households.
- 5.12. The prices paid for the outputs of market producers are economically significant. This means that the prices of outputs - and not the prices of inputs as for non-market production - can be collected and used to calculate PPPs for individual services purchased by government from market producers. The output prices to be collected are “total prices”. In countries where households pay the whole pur-

chasers' price to the market producer prior to being either completely or partially reimbursement by the government, the total price is the price that households pay before they are reimbursed. In countries where households pay only a portion of the purchasers' price to the market producer and the remainder is paid to the market producer by government, the total price is the composite price - that is, the sum of the non-reimbursable part paid by households and the part paid by government.^{4 5}

- 5.13. To facilitate the use of these output prices, it is important that government expenditure on individual services purchased from market producers is separated from government expenditure on government-produced services. From Box 5.7, it can be seen that the Eurostat-OECD expenditure classification clearly makes this distinction for government expenditures on health and education services. Government expenditure on health benefits and reimbursements is separated from government expenditure on the production of health services. And government expenditure on education benefits and reimbursements is separated from government expenditure on the production of education services.
- 5.14. Although it is possible to collect output prices for individual services purchased by government from market producers in principle, it is difficult to collect internationally comparable output prices for health and education services in practice. For Eurostat-OECD comparisons, output prices are only collected for medical goods and services delivered to outpatients. Output prices are not collected for hospital services. Nor are they collected for education services (other than adult educational programmes not defined by education level). Reference PPPs are used for hospital services and for education benefits and reimbursements.

Reference PPPs

- 5.15. Box 5.2 shows government expenditure broken down into 36 basic headings: 29 cover expenditure on individual services - that is, individual consumption expenditure by government; and seven cover expenditure on collective services - that is, collective consumption expenditure by government. No prices are collected for 27 of the basic headings. These are the basic headings highlighted in grey. The PPPs for these basic headings are based on price data, but price data that have been collected for other basic headings. Such PPPs are called “reference PPPs”. They are taken from elsewhere in the comparison to serve as proxies for the PPPs that would have been calculated had prices been collected for the basic headings for which no prices were collected. The reference PPPs are listed in Box 5.3.

Box 5.2: Individual services and collective services by basic heading

INDIVIDUAL SERVICES	
<i>Housing</i>	
13.01.11.1	Housing
<i>Health benefits and reimbursements</i>	
13.02.11.1	Pharmaceutical products
13.02.11.2	Other medical products
13.02.11.3	Therapeutic appliances and equipment
13.02.12.1	Out-patient medical services
13.02.12.2	Out-patient dental services
13.02.12.3	Out-patient paramedical services
13.02.12.4	Hospital services
<i>Production of health services</i>	
13.02.21.1	Compensation of employees: Physicians
13.02.21.2	Compensation of employees: Nurses and other medical staff
13.02.21.3	Compensation of employees: Non-medical staff
13.02.22.1	Intermediate consumption: Pharmaceutical products
13.02.22.2	Intermediate consumption: Other medical goods
13.02.22.3	Intermediate consumption: Therapeutic appliances and equipment
13.03.22.4	Intermediate consumption n.e.c.
13.02.23.1	Gross operating surplus
13.02.24.1	Net taxes on production
13.02.25.1	Receipts from sales
<i>Recreation and culture</i>	
13.03.11.1	Recreation and culture
<i>Education benefits and reimbursements</i>	
13.04.11.1	Education benefits and reimbursements
<i>Production of education services</i>	
13.04.21.1	Compensation of employees: Pre-primary and primary education
13.04.21.2	Compensation of employees: Secondary education
13.04.21.3	Compensation of employees: Post-secondary non-tertiary education
13.04.21.4	Compensation of employees: Tertiary education
13.04.22.1	Intermediate consumption
13.04.23.1	Gross operating surplus
13.04.24.1	Net taxes on production
13.04.25.1	Receipt from sales
<i>Social protection</i>	
13.05.11.1	Social protection
COLLECTIVE SERVICES	
14.01.11.1	Compensation of employees (collective services relating to defence)
14.01.11.2	Compensation of employees (collective services other than defence)
14.01.12.1	Intermediate consumption (collective services relating to defence)
14.01.12.2	Intermediate consumption (collective services other than defence)
14.01.13.1	Gross operating surplus
14.01.14.1	Net taxes on production
14.01.15.1	Receipts from sales

5.16. The choice of reference PPP is self-explanatory in most cases. For example, the reference PPPs for housing are the PPPs for actual rentals and the reference PPPs for gross operating surplus - which in practice equals consumption of fixed capital since net operating surplus is generally minimal - are the PPPs for gross fixed capital formation. When such corresponding proxies are not available to be used as reference PPPs, a neutral average is chosen in-

stead. For example, the reference PPPs for intermediate consumption - other than the intermediate consumption of collective services relating to defence - are the PPPs for individual consumption expenditure by households on the domestic market (excluding all basic headings with reference PPPs) and the reference PPPs for recreation and culture and for social protection are the PPPs for individual consumption expenditure by government (excluding

Box 5.3: Reference PPPs for individual services and collective services

Basic heading	Reference PPP
INDIVIDUAL SERVICES	
<i>Housing</i>	
13.01.11.1 Housing	PPPs for actual rentals
<i>Health benefits & reimbursements</i>	
<ul style="list-style-type: none"> ▪ 13.02.11.1 Pharmaceutical products ▪ 13.02.11.2 Other medical products ▪ 13.02.11.3 Therapeutic appliances and equipment ▪ 13.02.12.1 Out-patient medical services ▪ 13.02.12.2 Out-patient dental services ▪ 13.02.12.3 Out-patient paramedical services 	PPPs for household final consumption expenditure on: <ul style="list-style-type: none"> ▪ Pharmaceutical products⁽¹⁾ ▪ Other medical products⁽¹⁾ ▪ Therapeutic appliances and equipment⁽¹⁾ ▪ Out-patient medical services⁽¹⁾ ▪ Out-patient dental services⁽¹⁾ ▪ Out-patient paramedical services⁽¹⁾
13.02.12.4 Hospital services	PPPs for production of health services by government (without receipts from sales)
<i>Production of health services</i>	
Intermediate consumption: <ul style="list-style-type: none"> ▪ 13.02.22.1 Pharmaceutical products ▪ 13.02.22.2 Other medical goods ▪ 13.02.22.3 Therapeutic appliances and equipment 	PPPs for household final consumption expenditure on: <ul style="list-style-type: none"> ▪ Pharmaceutical products ▪ Other medical products ▪ Therapeutic appliances and equipment
13.03.22.4 Intermediate consumption n.e.c.	PPPs for individual consumption expenditure by households on the domestic market (excluding all basic headings with reference PPPs)
13.02.23.1 Gross operating surplus	PPPs for gross fixed capital formation
13.02.24.1 Net taxes on production	PPPs for production of health services by government (without net taxes on production and receipts from sales)
13.02.25.1 Receipts from sales	PPPs for production of health services by government (without receipts from sales)
<i>Recreation and culture</i>	
13.03.11.1 Recreation and culture	PPPs for individual consumption expenditure by government (excluding social protection, recreation and culture, and receipts from sales)
<i>Education benefits & reimbursements</i>	
13.04.11.1 Education benefits & reimbursements	PPPs for production of education services by government (without receipts from sales)
<i>Production of education services</i>	
13.04.22.1 Intermediate consumption	PPPs for individual consumption expenditure by households on the domestic market (excluding all basic headings with reference PPPs)
13.04.23.1 Gross operating surplus	PPPs for gross fixed capital formation
13.04.24.1 Net taxes on production	PPPs for production of education services by government (without net taxes on production and receipts from sales)
13.04.25.1 Receipts from sales	PPPs for production of education services by government (without receipts from sales)
<i>Social protection</i>	
13.05.11.1 Social protection	PPPs for individual consumption expenditure by government (excluding social protection, recreation and culture, and receipts from sales)
COLLECTIVE SERVICES	
14.01.12.1 Intermediate consumption (collective services relating to defence)	PPPs for gross fixed capital formation in machinery and equipment
14.01.12.2 Intermediate consumption (collective services other than defence)	PPPs for individual consumption expenditure by households on the domestic market (excluding all basic headings with reference PPPs)
14.01.13.1 Gross operating surplus	PPPs for gross fixed capital formation
14.01.14.1 Net taxes on production	PPPs for production of collective services by government (without net taxes on production and receipts from sales)
14.01.15.1 Receipts from sales	PPPs for production of collective services by government (without receipts from sales)

⁽¹⁾ Strictly speaking these are not reference PPPs as they have been calculated specifically to be used with both household expenditure and government expenditure. See paragraph 5.12 and footnote 4.

recreation and culture, social protection and receipts from sales).

- 5.17. The choice of the PPPs for gross fixed capital formation in machinery and equipment as the reference PPPs for the intermediate consumption of collective services relating to defence is less evident. The explanation is that the major part of intermediate consumption of defence consists of expenditure on machinery and equipment that are not dual purpose – that is, they are for military use only and can not be put to civilian use as well. Such expenditure is classified as intermediate consumption - and not as gross fixed capital formation - in the SNA 93 and the ESA 95.
- 5.18. There is a certain amount of recycling in the derivation of some of the reference PPPs. For example, the reference PPPs for hospital services are the PPPs for the production of health services by government (without receipts from sales). These reference PPPs are the weighted averages of the PPPs for compensation of employees, intermediate consumption, gross operating surplus and net taxes on production. Of these four sets of PPPs, only the PPPs for compensation of employees are based on specifically-collected price data. These are the input prices obtained through the survey of compensation of employees described below. The PPPs for intermediate consumption, gross operating surplus and net taxes on production are themselves reference PPPs.

Survey of compensation of employees⁶

- 5.19. The remaining nine basic headings in Box 5.2 – that is, those not highlighted in grey - all refer to compensation of employees. PPPs for these basic headings are calculated using the compensation of employees that participating countries are required to report for a selection of occupations in general government, public education and public hospitals. The selection is made by Eurostat and the OECD in consultation with the participating countries. The intention is to represent the various education and skill levels that are commonly to be found among employees working in these three government services. The selection is reviewed from time to time, but irregularly. Forty-six occupations are included in the current selection: forty civilian occupations, six military occupations. They are listed in Box 5.4. Those in *italics* appear more than once, usually under education services and other collective services. The civilian occupations are defined using job descriptions taken from the ISCO-88⁷. These descriptions specify the occupations in terms of the kind of work done and are attached to the survey questionnaire that countries have to complete each reference year. The military occupations are specified as NATO⁸ ranks and their country equivalents. They refer to members of the regular armed forces and not to conscripts.

- 5.20. The compensation of employees that participating countries are to report for the selected occupations is defined in Box 5.5 as comprising gross salaries and wages – that is, the basic salary or wage plus other cash payments over and above the basic salary or wage - employers' actual social contributions and imputed social contributions. The definition is consistent with that of the SNA 93 and the ESA 95 except for the exclusion from gross salaries and wages of overtime payments and benefits in cash and kind not related to the salary scale. Experience has shown that it is too difficult to obtain data on overtime that are comparable across countries. This results in volume measures that are marginally inflated, but their comparability is judged to be improved by ignoring overtime. It has also proved difficult for countries to evaluate benefits in cash and kind not related to the salary scale as they can vary from one government institution to another. In most cases, the contribution of such benefits to the total is negligible, so they too are omitted.
- 5.21. The compensation of employees to be reported for the selected occupations should not be extracted from government payrolls. Dividing the total compensation of employees paid to employees in a selected occupation by the total number of full-time employees (or full-time equivalents) in the selected occupation gives an average that is representative of the country, but it does not give an average that is comparable across countries. This is because the distribution of the employees in the selected occupation over the grades, categories and steps that make up the pay scale for the occupation will differ from country to country. Instead, the compensation of employees should be derived by a less representative but more comparable approach that involves working from government salary scales directly. The approach is described in the paragraphs below. Many participating countries find it difficult, if not impossible, to implement. Either they do not have the employment data required or the government pay system does not conform, or no longer conforms, to the model underlying the approach. These countries resort to extracting the compensation of employees from government payrolls or other statistical sources.

- 5.22. The prescribed approach is as follows. Underlying the compensations of employees paid by government are the basic salaries and wages that are laid down in government salary scales. Once the basic salary or wage has been established for an occupation, computing the compensation of employees is relatively straightforward because the other components of compensation of employees are normally related to the salary scale by being defined as percentage additions to the basic salary or wage. To determine the compensation of employees for the selected occupations, countries have first to locate the basic salary or wage for each selected occupation in the government salary scales. The procedure to be applied is explained in Box 5.6.

Box 5.4: Selected occupations

Production of health services	Physicians	Other medical staff	Non-medical staff	
01. Doctor, head of department	X			
02. Doctor, senior consultant	X			
03. Doctor	X			
04. Nurse, head of department		X		
05. Nurse, operating theatre		X		
06. Nurse		X		
07. Nursing auxiliary		X		
08. Physiotherapist		X		
09. Laboratory assistant		X		
10. Hospital chief executive			X	
11. Secretary I			X	
12. Cook			X	
Production of education services	Pre-primary & primary	Secondary	Post-secondary	Tertiary
13. Kindergarten teacher	X			
14. Primary school teacher	X			
15. Secondary school teacher		X	X	
16. Head teacher	X	X	X	X
17. University lecturer			X	X
06. Nurse	X	X		
24. Finance department manager	X	X	X	X
25. Executive official (skill level III)	X	X	X	X
26. Executive official (skill level IV)	X	X	X	X
27. Computer operator	X	X	X	X
28. Bookkeeping clerk	X	X	X	X
29. Data entry clerk	X	X	X	X
30. Secretary II	X	X	X	X
31. Telephone switchboard operator	X	X	X	X
32. Messenger	X	X	X	X
33. Maintenance electrician	X	X	X	X
34. Building caretaker	X	X	X	X
35. Cleaner	X	X	X	X
39. Social worker	X	X	X	X
Production of collective services	Defence	Other than defence		
18. Private of infantry regiment	X			
19. Commander of infantry regiment	X			
20. Able seaman	X			
21. Commander of frigate	X			
22. Airman	X			
23. Fighter pilot	X			
24. Finance department manager		X		
25. Executive official (skill level III)		X		
26. Executive official (skill level IV)		X		
27. Computer operator		X		
28. Bookkeeping clerk		X		
29. Data entry clerk		X		
30. Secretary II		X		
31. Telephone switchboard operator		X		
32. Messenger		X		
33. Maintenance electrician		X		
34. Building caretaker		X		
35. Cleaner		X		
36. Policeman/woman		X		
37. Prison guard		X		
38. Fire-fighter		X		
39. Social worker		X		
40. Town planner		X		
41. Civil engineer		X		
42. Draughtsman		X		
43. Construction labourer		X		
44. Driver		X		
45. Agricultural scientist		X		
46. Librarian		X		

Box 5.5: Compensation of employees

Compensation of employees includes all payments in cash and kind made by general government in a year. These payments in cash and kind comprise:

- **Gross salaries and wages** (before deduction of taxes and social contributions payable by employees) covering:
 - Basic salaries and wages as laid down in the salary scales;
 - Other payments, over and above the basic salary or wage, such as: housing or residence allowance, passage or leave allowance, family allowance (for the purpose of Eurostat-OECD comparisons this is taken to cover a married employee with two dependent children), special duty allowance or acting allowance, 13th month pay and other cash payments other than overtime payments. It is difficult to obtain data on overtime payments that are comparable across countries. *Overtime payments are not to be included when calculating the gross salaries and wages of selected occupations for Eurostat-OECD comparisons.*
 - Benefits in cash or kind that are not related to the salary scale, such as free or subsidised housing, transport allowance, reimbursement of medical expenses and the like. These benefits are difficult to evaluate, as they can vary from one general government institution to another, and in most cases are negligible relative to the total. *Such benefits are not to be included when calculating the gross salaries and wages of selected occupations for Eurostat-OECD comparisons.*
- **Employers' actual social contributions** consisting of the payments made by general government institutions to insurers for the benefit of their employees. These payments cover contributions for old age pensions, as well as for insurance against sickness, accident and disability. They are calculated on the basis of the schemes in operation in the various countries.
- **Imputed social contributions** representing the counterpart to social benefits paid directly by general government institutions without participating in, or establishing a fund, reserve or other special scheme for this purpose. Since these contributions do not involve actual cash flows, they have to be imputed. The imputations have to be done in line with the corresponding imputations made in the national account. For example, government may pay pensions to retired employees from general revenue. In such a case, national accountants usually evaluate the pension element by reference to the compensation paid to past employees during their term of employment and to the average pensions paid over recent years. The ratio, pensions paid per compensation of employees, supplies the contribution in the form of a rate which can be applied to the basic salary for each occupation.

5.23. The compensation of employees reported for each selected occupation must be annual. This is not a particularly difficult requirement as salary scales usually show annual amounts and any revisions to the salary scales that take place during the reference year are relatively straightforward to accommodate. When there are revisions, a weighted average needs to be calculated. This can be illustrated by returning to the example of an executive official with skill level III in Box 5.6. If a five per cent increase in salaries came into effect in October of the reference year, for the first nine months the salary for category T3 would be 46,800 and for the last three months it would be 49,140. The weighted average of the two provides the basic salary required: $([46,800 \times 9] + [49,140 \times 3]) / 12 = 47,385$.

5.24. The compensation of employees should also be the national average taking into account the discrepancies in compensation which may arise between the several levels of government – that is, between central, regional, state and local governments – and within the same level of government – that is, between different ministries and departments of central government or between different regional governments, state governments or local governments. Unless there are national salary scales, this can be a problem because access to the various salary scales that need to be consulted is often not readily available. Even if access is obtained, there is still the question of how to combine them. In principle some form of weighted average should be used.

5.25. One solution that countries have adopted to the absence of national salary scales for general government is to use only the salary scales of central government. The validity of this approach depends on the extent to which the wages and salaries paid by central government are representative of those paid by general government. Some adjustments may be necessary to make them more representative such as excluding the allowance paid to compensate for the higher costs associated with working in the capital city. But it is not a complete solution because there are occupations – such as teachers or doctors in some countries – that are employed by regional, state or local governments and not by the central government. For the selected occupations that fall into this group, the need to refer to the salary scales of the appropriate level of government remains. The most obvious, although not necessarily the most feasible, approach to this situation would be to draw – either purposively or at random – a small sample of the relevant government levels with “probability proportional to size”.

Reporting prices

5.26. Countries are required to report the compensation of employees and its components for each of the selected occupations listed in Box 5.4 on the electronic reporting form that Eurostat and the OECD provide with the survey questionnaire. On the same form, countries are also required to report for each

Box 5.6: Determining the basic salary for a selected occupation using a salary scale

Grades and Categories	Steps						
	1	2	3	4	5	6	7
P4	88,900	91,400	93,900	96,400	98,900	101,400	103,900
P3	76,800	78,800	80,800	82,800	84,800	86,800	89,000
P2	66,100	67,900	69,700	71,500	73,300	75,100	76,900
P1	53,600	55,000	56,400	57,800	59,200	60,600	62,000
T4	47,900	49,500	51,100	52,700	54,300	55,900	57,500
T3	41,200	42,600	44,000	45,400	46,800	48,200	49,600
T2	35,500	36,700	37,900	39,100	40,300	41,500	42,700
T1	31,100	32,100	33,100	34,100	35,100	36,100	37,100
W4	34,700	35,700	36,700	36,800	36,900	37,000	37,100
W3	31,300	32,300	33,300	34,300	35,300	36,300	37,300
W2	28,400	29,200	30,000	30,800	31,600	32,400	33,200
W1	25,700	26,500	27,300	28,100	28,900	29,700	30,050

- Employees in public administrations are usually paid on the basis of a salary scale such as the simplified version shown above. The scale is divided into grades – P, T and W. Grades generally correspond to levels of education or skills. The ISCO-88, for example, identifies four skill levels. Level I is defined as five years of primary education. Level II is defined as five to six years of secondary education supplemented or partly replaced by a period of on-the-job training. Level III is defined as three to four years of post-secondary education leading to an award not equivalent to a graduate university degree. And level IV is defined as three or more years of post-secondary education leading to an award of a graduate or postgraduate university degree or its equivalent. In the salary scale above, the W grade corresponds to skill levels I and II, the T grade corresponds to skill level III and the P grade corresponds to skill level IV.
- Within grades there are various career brackets over several categories – 1 to 4 above - and each category is itself divided into steps - 1 to 7 above. Each step is usually 12 months, though steps of 18 or 24 months are not uncommon. For each selected occupation the category that is most representative in each country is to be identified. The criterion that should be used for this is the number of employees in each of the categories associated with the selected occupation and taking the modal category. The appropriate step within the category is indicated by the seniority specified for the selected occupation. For convenience, the same seniority is specified for all the selected occupations, namely: five years or five steps if each step is 12 months.
- Take, for example, an executive official with skill level III – selected occupation number 25 in Box 5.4. Such officials would be associated with grade T, and possibly the lower categories of grade P, in the salary scale above. If the distribution of these officials over the relevant categories was 15 per cent T1, 25 per cent T2, 35 per cent T3, 20 per cent T4 and 5 per cent P1, then T3 being the most frequent would be the modal category. If each step is 12 months, the salary for category T3 with five years seniority – equivalent to five steps – will be 46,800. But if each step was 18 months or 24 months, five years seniority would be equivalent to four steps and a salary of 45,400 in the case of 18 month steps and to three steps and a salary of 44,000 in the case of 24 month steps.
- It can happen that the distribution of employees over the categories associated with a particular occupation is bimodal, or approximately bimodal. In such cases the salary of both categories should be determined and an arithmetic average taken of the two. For example, if in the distribution of executive officials in the previous paragraph categories T2 and T3 were both 30 per cent, the salary – assuming steps of 12 months - would be 40,300 for T2 and 46,800 for T3. In this case the basic salary for an executive official with skill level III would be the arithmetic average of the basic salaries established for these two categories – which is, $(40,300 + 46,800) / 2$ or 43,550.

selected occupation: the standard number of hours worked per week, the holiday entitlement (number of working days paid leave), the number of public holidays falling on working days during the reference year, and the percentage share of the occupation within the basic heading for which it has been selected⁹.

- 5.27. The standard number of hours worked per week and the number of working days taken as holidays should refer to an employee working in the selected occupation at the modal category with the specified years of seniority – that is, the employee to whom the reported compensation of employees refers. These data are used by Eurostat and the OECD to standardise the compensation of employees across countries. The norm applied is 1710 hours – that is, 52 working weeks, each of 38 hours duration, less 7 working weeks (or 35 working days) of paid leave and public holidays. The compensation of employ-

ees of selected occupations working less than 1710 hours are increased proportionally. The compensation of employees of selected occupations working more than 1710 hours are decreased proportionally.¹⁰

- 5.28. The percentage shares of the selected occupations within their basic headings should refer to the wider groups of employees that the selected occupations represent and not just to the employees in the selected occupations. The selected occupations are a sample. And each occupation selected represents a stratum of employees that have comparable occupations and similar levels of compensation of employees. The percentage shares are to relate to these occupational strata. But the sample is purposive and, in the absence of explicit sampling ratios, these percentage shares have to be derived in the manner described in Box 5.7.

5.29. Eurostat uses the percentage shares in conjunction with the standardised compensation of employees to obtain expenditure weights for each selected occupation that can be used when calculating PPPs for the basic heading to which it is assigned. For example, assume that for a basic heading covering compensation of employees three occupations have been selected - X, Y and Z. Assume also that the standardised compensation of employees for the three occupations are 150 for X, 100 for Y and 80 for Z and that percentages shares of the three occupations are 20 for X, 30 for Y and 50 for Z. The total compensation paid to persons working in these occupations would then be $[150 \times 20] + [100 \times 30] + [80 \times 50]$ or $3000 + 3000 + 4000$ or 10,000 and the expenditure weights would be 30 per cent for X, 30 per cent for Y and 40 per cent for Z.

Validation of prices

5.30. There are two edits that participating countries should carry out before they return the completed reporting form to Eurostat or the OECD. The first is to check the internal coherency of the data set. For example, it is usually the case that: doctors earn more than nurses; head teachers earn more than other teachers; officers in the armed forces earn more than privates, able seamen and airmen; executive officials with a university degree (skill level IV) earn more than executive officials without a university (skill level III); etc. Income differentials be-

tween occupations that are contrary to expectations should be verified. And errors identified in this way should be corrected.

5.31. The second edit is to check the consistency between the compensation of employees that are to be reported for the latest reference year and the compensation of employees that were reported for the previous reference year. Differences can be expected between the two data sets because either the salary scales have changed between the two periods or, but less likely, the modal categories have changed. Discrepancies that cannot be explained in this way should be verified. If there are errors, they could be with either or both data sets. In all cases, errors should be corrected. Errors in the compensation of employees previously reported should be brought to the attention of Eurostat or the OECD.

5.32. Eurostat and the OECD will repeat these two edits and request countries to explain or correct the discrepancies observed. They will also apply the Quarta editing procedure to compare the price levels of the compensation of employees reported for the selected occupations across countries. The outliers identified through this procedure will be returned to the countries reporting them for verification. Countries are required to either correct the compensation of employees originally reported or to confirm that they are correct.

Box 5.7: Determining the percentage shares of selected occupations within a basic heading

Grades and categories	Part I							Part II					
	Number of employees in selected occupations					Total number of employees in selected occupations	Total number of employees covered by the basic heading	Number of employees represented by selected occupations					
	A	B	C	D	E			A	B	C	D	E	
P4	30					30	200	200					
P3	50	20				70	700	500	200				
P2	20	80				100	1600	320	1280				
P1		50	50			100	1800		900	900			
T4		50	100			150	1100		365	735			
T3			50	50		100	1250			625	625		
T2				100		100	1950				1950		
T1				50		50	750				750		
W4				50	50	100	150				75	75	
W3					100	100	200					200	
W2					50	50	100					100	
W1					50	50	200					200	
Total	100	200	200	250	250	1000	10,000	1020	2745	2260	3400	575	
Percentage shares to be reported							100	10	27	23	34	6	

1. The table above refers to an unspecified basic heading covering compensation of employees paid by general government. It has two parts. Part I shows the distribution of employees over the grades and categories of the salary scale from Box 5.6 for: five selected occupations (A, B, C, D and E); the total number of employees in the selected occupations (1000); and the total number of employees covered by the basic heading (10,000).
2. Part II shows the total number of employees covered by the basic heading (10,000) distributed over the grades and categories of the Box 5.6 salary scale and the occupational strata represented by the selected occupations (A, B, C, D, and E). The distribution has been derived by assuming that the total number of employees covered by the basic heading is distributed over the occupational strata and the grades and categories in the same proportions as the employees in the selected occupations (1000) are distributed in Part I. The total shown in bold for an occupational stratum is number of employees that the corresponding selected occupation represents. For example, selected occupation A actually represents 1020 employees and not just the 100 employees of Part I.
3. It is the percentage shares based on the totals for the occupational strata that are to be reported.

ANNEX TO CHAPTER 5: PRODUCTIVITY ADJUSTMENTS

- i. The input-price approach as applied by Eurostat and the OECD does not take into account differences in productivity between the producers of non-market services in different countries. It assumes that non-market producers are equally efficient and that the same level of input will yield the same volume of output regardless of the country in which the non-market producer is operating. This assumption might be tenable when countries are at similar levels of income - as were most of the nine participating countries in the early 1970s when the input-price approach was first used by Eurostat. But, when income levels vary to the extent they do among countries currently participating in Eurostat-OECD comparisons, the assumption is difficult to defend and the anomalies it gives rise to have at least to be recognised.
- ii. Box A shows the rankings of the per capita volume indices of GDP and GFCE for the 43 countries that participated in the 1999 Eurostat-OECD comparison. On the supposition that there is a positive correlation between the level of a country's income and its level of government expenditure, the rank of a country's per capita volume index of GFCE can be expected to shadow the rank of its per capita volume index of GDP. The two would not necessarily be the same, but they would be broadly similar. This clearly was not so for the United States, Switzerland, Ireland, Sweden, France, Israel, the Czech Republic, Korea, Hungary and the Slovak Republic in 1999.
- iii. Some of the differences in rank are real differences that can be explained by the varying political, cultural, demographic and institutional circumstances of the countries. Others are not real. They arise because the productivity differences that exist between the non-market producers of the countries were not taken into account when the indices were calculated. Differences in productivity are being disguised as price differences. Hence, the volumes of output of non-market producers in countries whose cost of inputs are relatively low are being overestimated and the volumes of output of non-market producers in countries whose cost of inputs are relatively high are being underestimated. The relative cost of inputs is reflected by the comparative price levels indices for GFCE shown in the last column of Box A.
- iv. The failure to take account of productivity differences between the producers of non-market services in different countries does not only affect the PPPs and volume indices of health services, education services and collective services. It also affects the PPPs and volume indices of the main aggregates of which these expenditure categories are a part, namely: actual individual consumption (by households), actual collective consumption (by government) and GDP. And it is the effect on the volume indices of these aggregates – particularly the volume indices of GDP – that are the primary concern. Non-market services are not specifically a problem for international spatial comparisons. They are also a problem for national temporal comparisons. But it is a much more serious problem for international comparisons. Differences in the productivity of producers of non-market services between countries are significantly larger than the year-to-year changes in productivity of non-market producers of individual countries.
- v. One solution would be to complement the input-price approach with adjustments for differences in productivity. This was the strategy adopted by Statistics Austria when it organised the Group II comparisons covering eastern and central European countries for the European Comparison Programme (ECP).¹¹ An adjustment was made for differences in labour productivity. It was based on the assumption that productivity differences between the non-market producers of countries were roughly equal to the productivity differences between their market producers. The market sector was defined as all economic activities except agriculture and non-market services. Productivity was defined as value added per employee. And nominal market-sector value added was converted to real market-sector value added with the PPPs for that part of final expenditure on GDP that was generated by market activities.
- vi. Box B shows two sets of volume indices for GDP per capita for the thirteen transition economies that constituted Group II in 1996. Both sets of indices were obtained by the input-price approach. The first set are the indices before being adjusted for differences in labour productivity. The second set are the indices after being adjusted.¹² The per cent differences between two sets are large and, if the adjusted indices are to be believed, large enough to be of concern.¹³
- vii. EU Member States and OECD Member Countries have not been in favour of such an adjustment being employed in Eurostat-OECD comparisons. Besides considering the approach too simple for their economies, they question its underlying assumption, arguing that productivity differences between countries are likely to be smaller in the non-market sector than they are in the market sector because the productivity of non-market producers is less dependent on capital inputs than the productivity of market producers. More generally, they argue against productivity adjustments because they are inevitably based on assumptions which cannot be verified without a genuine measurement of output. And, if output could be measured, then input methods would not be necessary.

Box A: Per capita volume indices for GDP and GFCE and their rankings, 1999

Countries participating in the 1999 Eurostat-OECD comparison	Per capita volume indices		Ranking		Comparative price levels
	GDP	GFCE	GDP	GFCE	GFCE
Luxembourg	190	149	1	7	138
United States	149	104	2	24	123
Norway	128	166	3	5	117
Switzerland	127	90	4	30	146
Denmark	124	185	5	2	121
Iceland	122	197	6	1	97
Canada	117	129	7	12	83
Netherlands	117	170	7	4	91
Ireland	114	104	9	24	91
Austria	113	131	10	11	104
Japan	110	120	11	16	127
Australia	109	125	12	13	80
Belgium	109	137	12	9	101
Germany	109	113	12	19	116
Italy	106	105	15	22	94
Sweden	104	166	16	5	117
Finland	103	137	17	9	105
United Kingdom	103	123	17	14	98
France	102	145	19	8	102
Israel	88	176	20	3	73
Cyprus	86	102	21	26	64
Spain	84	93	22	29	76
New Zealand	83	110	23	21	67
Portugal	75	105	24	22	57
Greece	70	76	25	34	63
Slovenia	70	116	25	17	47
Czech Republic	60	122	27	15	23
Korea	60	44	27	40	54
Malta	56	97	29	27	48
Hungary	51	116	30	17	24
Slovak Republic	49	112	31	20	17
Poland	40	61	32	37	27
Estonia	38	97	33	27	23
Mexico	37	43	34	41	33
Croatia	37	80	35	32	39
Lithuania	34	88	36	31	19
Latvia	29	78	37	33	19
Bulgaria	28	52	38	39	12
Macedonia	27	58	39	38	48
Russian Federation	27	69	39	43	8
Turkey	26	36	41	42	31
Romania	24	42	42	42	13
Ukraine	16	62	43	36	5
OECD	100	100	---	---	100

Box B: Per capita volume indices for GDP before and after productivity adjustments

ECP Group II 1996	GDP per capita volume indices		Per cent difference
	Input prices	Productivity adjusted	
Austria	100.0	100.0	---
Slovenia	59.7	53.6	-10.2
Russia	30.4	26.1	-14.2
Estonia	30.2	24.8	-17.9
Romania	29.8	25.0	-16.1
Croatia	28.4	23.8	-16.2
Lithuania	26.0	21.4	-17.6
Belarus	23.3	19.3	-17.3
Latvia	22.8	18.9	-17.1
Bulgaria	22.6	18.9	-16.2
Macedonia	19.1	14.1	-26.2
Ukraine	15.0	11.6	-22.6
Albania	13.0	11.0	-15.4
Moldova	9.5	7.3	-23.0

- viii. Many outputs of non-market producers of individual services are equivalent to those of market producers of individual services. An alternative to productivity adjustments would be to value these outputs of the non-market sector at the same market prices as their counterparts in the market sector and to calculate PPPs for non-market services accordingly. But, even if a non-market service is identical to a market service, there is no reason to believe that the production of the service by non-market producers is as efficient as that of market producers. Non-market producers are under no constraint to maximise profits or minimise losses and it cannot be assumed that they employ inputs with a view to equating average real wages and marginal product. Their production, in other words, may be less efficient and more costly than market production and have correspondingly higher shadow prices. The cost differences between market and non-market producers are likely to be greater in some countries than in others. To use the prices of market output to calculate PPPs for non-market output would also be making an assumption, albeit implicit, about the productivity of market and non-market producers.¹⁴
- ix. Reference PPPs - or, more specifically, the PPPs for individual consumption expenditure by households – have been proposed as an alternative to the input-price approach.¹⁵ Two arguments have been advanced for adopting this alternative. The first is that, as the purpose of Eurostat-OECD comparisons is primarily to compare economic welfare, it is justifiable to use the PPPs for household expenditure as reference PPPs for government expenditure because it provides a measure of consumption forgone. The second is that the PPPs for household expenditure are better estimates of the PPPs for government expenditure than the PPPs obtained through the input-price approach.
- x. Neither of these arguments has found support among EU Member States and OECD Member Countries. The first argument is based on the wrong premise. The purpose of Eurostat-OECD comparisons is to compare real GDP across participating countries. In so far as GDP per capita is a measure of economic welfare, its purpose is to compare economic welfare. But it is output that is being compared, not consumption or consumption forgone. The second argument is difficult to justify theoretically and there is little empirical evidence to support it. While use of a reference PPP appears to remove some of the counter-intuitive results of the input-price approach, it produces other results that are equally counter-intuitive.
- xi. Efforts by Eurostat and the OECD to develop other approaches to non-market services have been handicapped by lack of data and the poor comparability of the information that was available. For example, an attempt to use physical measures of output to obtain the volume ratios directly for education and health services in EU Member States foundered on the lack of comparable physical measures of output.¹⁶ This obstacle to the development of alternative approaches has become even greater with the increase in the number of countries participating in Eurostat-OECD comparisons. It is unlikely that either Eurostat or the OECD will find an acceptable replacement for the input-price approach in the short or medium term. In the long term, the solution will probably be found at the national level first.

- ¹ *System of National Accounts 1993*, Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, 1993.
- ² *European System of Accounts 1995*, Eurostat, Luxembourg, 1996.
- ³ Non-market services are also called “comparison resistant services” because, as explained in the chapter, they have no economically-significant prices with which to value outputs, their units of output cannot be otherwise defined and measured, the institutional arrangements for their provision and the conditions of payment differ from country to country, and their quality varies between countries but the differences cannot be identified and quantified.
- ⁴ The PPPs calculated with these output prices are to be used for both household expenditure and government expenditure on individual services purchased from market producers to avoid double counting. Suppose, for example, that the quantity of health services purchased is 1000 units and that the price per unit is 10 € of which households pay 2 € and government 8 €. In the national accounts, 2000 € will be recorded as household expenditure and 8000 € will be recorded as government expenditure. If the amounts actually paid – that is, 2 € by households and 8 € by government are used to deflate these expenditures, it will seem that both households and government have each purchased 1000 units or 2000 units in total. But if the total amount paid - that is 10 € - is used, households will appear to have purchased 200 units and government 800 units - a total of 1000 units.
- ⁵ The rolling benchmark approach requires the prices of consumer products not surveyed during the reference year to be extrapolated using CPI sub-indices. As CPI sub-indices are based on prices actually paid by households, extrapolations of composite market prices can be problematic if the share of the composite price paid by household (and therefore the share paid by government) changes in years when the prices for the goods and services in question are not surveyed.
- ⁶ Compensation of employees is by far the largest cost component of government expenditure on non-market services. In EU Member States and OECD Member Countries, it accounts on average for over 50%, 60% and 70% respectively of expenditure on government-produced collective, health and education services.
- ⁷ *International Standard Classification of Occupations 1988*, International Labour Office, Geneva, 1990.
- ⁸ North Atlantic Treaty Organisation.
- ⁹ Countries participating in OECD comparisons are not asked to report the percentage shares of the occupations.
- ¹⁰ Eurostat standardises the working hours for all occupations except those in education. The OECD standardises the working hours for all occupations other than those in defence, education and health.
- ¹¹ See, for example, *International Comparison of Gross Domestic Product in Europe 1993: Results of the European Comparison Programme*, Conference of European Statisticians Statistical Standards and Studies No. 47, United Nations, New York and Geneva, 1997.
- ¹² Official productivity adjustments for Group II countries were stopped after the 1993 comparison. Even so, Statistics Austria continued making productivity adjustments for Group II countries and the adjusted results were presented at ECP consultations for analytical purposes. The two sets of indices for 1996 were extracted from *Purchasing Power Parities (PPPs)*, unpublished OECD document, STD/NA(98)16.
- ¹³ The differences between unadjusted and adjusted per capita volume indices become greater the lower the level of aggregation. At the level of specific non-market services such as health and education, the differences, if they are real differences, are large enough to question the usefulness of the volume comparisons of these non-market services that are based on unadjusted indices.
- ¹⁴ See *Purchasing Power Parities for Non-Market Services: An Assessment of Alternative Methods*, E. Dean, unpublished paper presented at the Conference of the International Comparison Programme, World Bank, Washington, March 2002.
- ¹⁵ See *Review of the OECD-Eurostat PPP Programme*, I. Castles, unpublished OECD document, STD/PPP(97)5, September 1997 and *A PPP Comparison for the NIS, 1994, 1995 and 1996: Final Report*, Centre for the Co-operation with Non-Members, OECD, Paris, 1999.
- ¹⁶ *Calculation of purchasing power parities and volume ratios between Member States in the area of education and health services*, W. Krug and N. Rehm, University of Trier, Germany, 1992.