

CENTRAL BUREAU OF STATISTICS  
The Netherlands  
National Accounts Research Division

BENEFITS FROM PRODUCTIVITY GROWTH AND THE DISTRIBUTION OF INCOME

Steven J. Keuning\* )

\* ) The author is chief of the National Accounts Research Division. He is grateful to Wim van Veen and various other colleagues for their useful comments on an earlier version.

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Netherlands Central Bureau of Statistics

Nr. NA-042  
1990

## BENEFITS FROM PRODUCTIVITY CHANGE AND THE DISTRIBUTION OF INCOME

### Abstract

This paper sketches a framework for analyzing the relation between the allocation of benefits from productivity growth and changes in the primary distribution of income. We start with a discussion on the measurement of multifactor productivity. Next, changes in the average wage rate by industry are related to changes in the productivity, in the terms of trade, in the labour force composition, and in the mark-up rate by industry. Then we focus on changes in the average wage rate by labour category. Finally, shifts in the household primary income distribution are derived from changes in the employment and remuneration rate of production factors supplied by each household group.

## Contents

1. Introduction	1
2. Measurement of multifactor productivity change	4
3. Correcting input volumes for technical change	12
4. Distribution of the fruits of technical progress	14
5. Concluding remarks	20
Notes	22
References	26



## 1. Introduction

Estimates of productivity change tend to provoke lively discussions. The debate usually centres around the methods applied and the causes for varying productivity gains over time and between countries.<sup>1</sup> Emphasis on the origin of technical progress coincides with neglect of another set of interesting questions, related to the distribution of the benefits of productivity growth.

Here, this distribution is viewed from various angles. First, it is important to distinguish several production activities. Technical change does not proceed at the same rate in every industry, and this may entail that in some industries there is more room for improvement in the remuneration rate of production factors than in others. Secondly, allocation of the benefits within each industry needs to be studied at a rather disaggregated level (distinguishing, for instance, various types of labour). Obviously, the proportions accruing to each production factor also vary by industry. Last but not least, it is the household income distribution which matters. This means that household income changes are decomposed such that these changes can be partly ascribed to technical progress in the production activities employing inputs supplied by the households concerned.

Whereas productivity analysis is usually confined to showing the distribution of the benefits over aggregate capital and labour inputs, this is increasingly considered as unsatisfactory. For instance, labour force composition changes obviously affect both average efficiency and the wage level. The development of the Social Accounting Matrix (SAM) framework, which integrates national accounts and distributional data, has enabled a more detailed and reliable empirical treatment.<sup>2</sup> SAMs typically contain a fund of information on factor income and employment, by factor type and production activity on the one hand, and by institutional sector (including several household groups) and factor type on the other hand.

This paper attempts to demonstrate that two SAMs for different years

can serve to analyze shifts in the primary distribution of income. Productivity growth is an important factor in this regard, but various other changes (e.g. price changes) also play a role. More specifically, a change in the rate of factor earnings in an industry can be related to: a) (gross) productivity change, b) a shift in the industry's terms of trade, and c) an adjustment of the output price. An interesting empirical question is of course whether differences across industries in the relative importance of each of these three developments can be associated with variations in the distribution of additional net revenues.

The measurement of productivity change is not without ambiguity. Often, only labour productivity, that is (volume of) output per (volume of) labour input, is computed. This is the most simple indicator from a statistical point of view, as outputs and labour inputs can be quantified rather easily. However, this measure tells us very little about the efficiency of production or the assiduity of workers. Since the amount and effectiveness of assets used in production are also a crucial determinant of output, this should be taken into account as well. Unfortunately, that gives rise to considerable aggregation problems. Capital and labour must be combined in a production function or in an index which can serve to compare productivity levels. In that case, one usually speaks of multifactor productivity or even of 'total' factor productivity. Instead of output, value added 'volume' changes are frequently applied when computing this indicator. Finally, one can aim at incorporating volume changes in all market inputs (that is, all primary and intermediate inputs) and confront these with the development of output volume.

It is well-known that estimates of industry-level efficiency gains depend on the kind of framework which is applied. For instance, measured increases in productivity are almost universally higher when intermediate inputs are left out of consideration. Yet, we would argue for incorporating intermediate input price and volume changes into the analysis<sup>3</sup>. Experiences in the last one and a half decade show that in most countries drastic revisions in the structure of relative prices have occurred, with a major impact on intermediate input use and value added

in many industries. In turn, these shifts in the terms of trade among industries have affected the distribution of income by factor components.

Another controversy concerns the measurement of capital input, or actually the measurement of inputs in general. Again, the side one takes in this discussion has a substantial impact on the results. Therefore, this issue will be addressed here as well.

The sequence in this paper is as follows. First, the traditional (Hicksian) measure of multifactor productivity change is enunciated, using both a value added and a total output accounting framework. Special attention is paid to a subdivision of operating surplus into a) own-account labour input, b) own-account input of (tangible) capital goods, and c) input of non-produced (mainly financial) capital services.

Subsequently, a Harrodian framework is set out, including an adjustment of the measurement of produced inputs, as proposed by Read [1968]. Next, it is shown how changes in the distribution of income by factor components can be associated with productivity gains, shifts in the employment of inputs and relative price changes. In turn, the effects on the household income distribution are dealt with. The paper winds up with a review of what has not yet been taken into account and with some policy conclusions.

## 2. Measurement of Multifactor Productivity Change

Traditionally, the measurement of multifactor productivity change starts from a static accounting relationship which presents the distribution of value added and includes both volume and unit value variables. Deleting for the moment the subscripts for the time-period and the industry in question, we have:

$$WL + P_k K = P^v V, \quad (1)$$

where  $V$  = constant price value added at factor costs,

$L$  = labour input,

$K$  = own-account input of services of capital goods,

$P^v$  = value added price index,<sup>4</sup>

$P_k$  = (average) rental price of capital goods input, and

$W$  = nominal (average) wage rate.

Note that  $K$  is measured as the flow of services derived from capital goods owned by the firm in the current period. This flow is comparable to e.g. the volume of intermediate inputs obtained from a real estate company, if the office was rented instead of purchased. The (imputed) rental price for this own-account use of capital goods equals  $P_k$ . It is likely that  $P_k K$  minimally covers depreciation costs of the capital stock.

For the moment, it is assumed that the financing inputs (for making available productive assets and working capital) are not rewarded, and that there is neither a premium for risk-taking nor a quasi-rent for lack of perfect competition enjoyed by the producer in any relevant market. Net real holding gains on owned assets are excluded as well.

Changes at any point in time are then related as follows:

$$WL \left( \frac{dW/dt}{W} + \frac{dL/dt}{L} \right) + P_k K \left( \frac{dP_k/dt}{P_k} + \frac{dK/dt}{K} \right) = P^v V \left( \frac{dP^v/dt}{P^v} + \frac{dV/dt}{V} \right). \quad (2)$$

Or, introducing the notation  $\frac{dL/dt}{L} \equiv \dot{L}$  etc.,

$$\frac{WL}{P^V V} (\dot{W} + \dot{L}) + \frac{P_k K}{P^V V} (\dot{P}_k + \dot{K}) = \dot{P}^V + \dot{V}. \quad (3)$$

Still disregarding intermediate inputs for the moment, it can be asserted that the constant price, gross value added in any year depends on the amount of labour and capital inputs used and on the technology in that period, as represented by a transformation function:

$$V = f ( L, K, t). \quad (4)$$

This changes in the following way:

$$\frac{dV}{dt} = \frac{\delta f}{\delta L} \frac{dL}{dt} + \frac{\delta f}{\delta K} \frac{dK}{dt} + \frac{df}{dt}. \quad (5)$$

Or:

$$\frac{df/dt}{f} = \frac{dV/dt}{V} - \frac{\delta f/\delta L}{V/L} \frac{dL/dt}{L} - \frac{\delta f/\delta K}{V/K} \frac{dK/dt}{K}. \quad (6)$$

Or:

$$\dot{f} = \dot{V} - \alpha \dot{L} - \beta \dot{K}, \quad (7)$$

with  $f$  = multifactor productivity change, based on a value added accounting framework,

$\alpha$  = labour input elasticity of value added, and

$\beta$  = capital input elasticity of value added.

Notice that  $f$  represents the change in value added which cannot be ascribed to a change in the use of the labour and capital inputs. Under constant returns to scale (no fixed inputs),  $\alpha$  and  $\beta$  add to one. According to the neo-classical theory, factor inputs are rewarded according to their marginal productivity:

$$\frac{\delta f}{\delta L} = \frac{W}{P^V}, \quad \text{and} \quad \frac{\delta f}{\delta K} = \frac{P_k}{P^V}. \quad (8)$$

Substituting into (6) yields:

$$\dot{f} = \dot{V} - \frac{WL}{P^V V} \dot{L} - \frac{P_k K}{P^V V} \dot{K}. \quad (9)$$

This is the familiar neo-classical equation of factor productivity growth, measured as the growth rate of constant price value added minus the growth rates of factor inputs, weighted with their respective income shares. The distribution of the fruits of technical progress is obtained by substituting equation (9) into (3):

$$\dot{f} = \frac{WL}{P^V V} \dot{W} + \frac{P_k K}{P^V V} \dot{P}_k - \dot{P}_V. \quad (10)$$

So the productivity change is passed on to the owners of the production factors or to the consumers in the form of lower prices.

The above analysis is confined to the value added components, whereas growth accounting should actually deal with the relationship between changes in gross output and all inputs. Suppose that the economy under consideration can be divided into N homogeneous production activities which all generate a single characteristic commodity. Imported commodities can be classified in the same way. A subset of these production activities, G, rents out various types of capital goods. We distinguish M types of wage labour and M types of analogously classified, self-employed labour. Finally, there are F types of non-produced capital inputs. The input-output relationships are then (deleting again the time subscript):

$$\sum_{j \in N} P_j X_{ji}^d + \sum_{j \in N} P_j^m X_{ji}^m + \sum_{m \in M} W_m L_{mi}^p + \left[ \sum_{m \in M} W_m L_{mi}^u + \sum_{k \in G} P_k K_{ki} + \sum_{c \in F} R_c C_{ci} \right] = \Gamma_i P_i Q_i, \quad i \in N, \quad (11)$$

where Q = output (volume),  
X<sup>d</sup> = intermediate input (volume) of domestically produced commodities,  
X<sup>m</sup> = intermediate input (volume) of imported commodities,  
L<sup>p</sup> = (paid) wage labour input (employment),  
L<sup>u</sup> = (unpaid) own-account labour input (self-employment),  
K = constant price input of services of own-account capital goods,  
C = (non-produced) capital input  
P = producers' price of domestically produced commodities,  
P<sup>m</sup> = landed costs' price of imported commodities,  
W = nominal wage rate,  
R = rate of return on (non-produced) capital input, and  
Γ = basic price/producers' price ratio (the former excludes the net indirect tax rate).

Total input (at basic prices) consists of intermediate inputs, (paid) wages and salaries, and gross operating surplus (equal to the term in square brackets on the left-hand side of the above equation). In fact, gross operating surplus consists of (at least) three separable components: a) a compensation for the input of own-account labour, b) an (imputed) rental for the use of own-account (tangible) capital goods, and c) a return on the investment of non-produced (mainly financial) capital. The fundamental difference between a reward for the use of produced capital goods and a reward for the investment of non-produced (financial) capital is frequently overlooked.

Often, capital input costs are approximated as the sum of returns on a limited number of types of own-account capital goods. These returns are then assumed to be equal to the stocks of various capital goods times a rate of return which may differ by type of capital good but not by using industry. Non-produced capital inputs are disregarded. However, this is not very realistic.<sup>5</sup> The returns on investment cannot be allocated to capital stock 'volumes'. In fact, capital input also includes working capital costs. Before someone can start producing, a fund must be available to pay for intermediate inputs, for wages and salaries, for an

opportunity rental of own-account capital goods, and for an opportunity wage for the entrepreneur and unpaid family workers during the production process.

Moreover, it is not the 'volume', but the total value of all assets owned by the firm (at prices prevailing before the start of the current production cycle) which represents an investment that must be remunerated. Either the entrepreneur or somebody else postpones consumption to finance this amount. In this regard, varying rates of return should lead to distinguishing several types of financial capital inputs (e.g. long-term financing versus short-term financing, and own-account financing versus loans). In all cases, the investment equals the use of this input during the current period.

Non-produced capital is not limited to financial capital, however. Natural resources (land, subsoil assets etc.) also belong to this category. In many industries, assets like goodwill, patents, trademarks and such are not negligible either. Goodwill should be seen so as to include the 'institutional network' capital which may lead to monopoly profits. Finally, a risk element should be incorporated. Summarizing, comprehensive productivity analysis requires that capital income is subdivided into various components with an approximately uniform remuneration rate throughout the economy. However, there will always be a residual which is specific to the production activity in which it was generated.

In empirical work, a major problem exists as to the split of operating surplus into several parts which can be decomposed into price and volume components. The solution may proceed in stages. First, in each industry operating surplus generated by unincorporated firms ('mixed income') should be singled out. Secondly, if data are available on the labour input (in terms of working hours) of unpaid workers, their "wage rate" can be approximated by putting them on a par with their hired colleagues with the same background (labour type) in the same production activity. Thirdly, a lower bound for the rental of various own-account capital goods can be found in (actual) depreciation costs. Besides, it may be assumed

that the price of using up a capital good changes with the price of buying a new specimen of the same kind (the issue of quality improvement is referred to the next section of this paper). In principle, one could just look at changes in the number and the expected remaining length-of-life of each capital good in each year to determine volume changes.<sup>6</sup> In practice, capital goods will have to be aggregated into a manageable number of categories using relative base-year prices. That gives us the second part of operating surplus.

At present, decomposition of the third part is virtually impossible within a Social Accounting Matrix (or input-output table) framework. It requires the existence of balance sheet data for each firm. Even if that information would be available, there is the problem of the statistical unit. Financing decisions are commonly made at the level of the corporation (the institutional unit). These corporations may be subdivided into various establishments (production units) which are involved in different production activities. A beginning of a solution to this problem consists of showing value added in the national accounts in a three-way table: by institutional (sub)sector, by production activity and by value added category (i.e. by production factor). Some time ago, Dutch national accountants have made a proposal in this direction (see van Bochove and van Tuinen [1986]).

For the moment, this difficulty is circumvented by confining the productivity analysis to the productivity of produced inputs and labour.<sup>7</sup> It is assumed that the return on non-produced capital input can be expressed as a mark-up over current costs (cf. Fischer et al. [1985: p.26, 33-34]). Equation (11) now turns into:

$$(1+\mu_i) \left( \sum_{j \in N} P_j X_{ji}^d + \sum_{j \in N} P_j X_{ji}^{m,m} + \sum_{m \in M} W_{mi} L_{mi}^P + \sum_{m \in M} W_{mi} L_{mi}^u + \sum_{k \in G} P_k K_{ki} \right) = \Gamma_i P_i Q_i, \quad i \in N,$$

or:

$$\sum_{j \in N} P_j X_{ji}^d + \sum_{j \in N} P_j X_{ji}^{m,m} + \sum_{m \in M} W_{mi} L_{mi}^P + \sum_{m \in M} W_{mi} L_{mi}^u + \sum_{k \in G} P_k K_{ki} = \frac{\Gamma_i P_i}{\pi_i} Q_i, \quad i \in N, \quad (12)$$

where  $\mu$  = mark-up rate, and

$$\pi \equiv 1 + \mu.$$

Notice that the rent paid for capital goods which are hired from another unit is already settled in the intermediate input block of the Social Accounting Matrix (namely as input of business services). Above, we stated that the (imputed) rental of own-account capital goods can be approximated by depreciation costs. Since depreciation allowances for (tangible) capital "used up" within the period do not fundamentally differ from the purchase of intermediate inputs, the argument which follows is most clear if they are indeed treated as such. In the input-output block of the SAM, they are thus moved from value added to the row of the production activity generating the capital good concerned (so the  $P_k K_{ki}$  become part of the intermediate inputs in the above equation).<sup>8</sup> Simultaneously, replacement investments are removed from fixed capital formation. Total value added and total final demand are now equal to Net Domestic Product.

Relating the growth rates and going through the same exercise as in the previous section yields:

$$\dot{\tilde{f}}_i = \dot{Q}_i - \sum_j \frac{P_j X_{ji}^d}{\Gamma_i P_i Q_i / \pi_i} \dot{X}_{ji}^d - \sum_j \frac{P_j^m X_{ji}^m}{\Gamma_i P_i Q_i / \pi_i} \dot{X}_{ji}^m - \sum_m \frac{W_{mi} L_{mi}^P}{\Gamma_i P_i Q_i / \pi_i} \dot{L}_{mi}^P - \sum_m \frac{W_{mi} L_{mi}^u}{\Gamma_i P_i Q_i / \pi_i} \dot{L}_{mi}^u, \quad i \in N, \quad (13)$$

where  $\dot{\tilde{f}}_i$  = multifactor productivity change, based on a total output accounting framework.

And, analogous to the substitutions made to arrive from equation (9) at equation (10):

$$\dot{\tilde{f}}_i = \sum_j \frac{P_j X_{ji}^d}{\Gamma_i P_i Q_i / \pi_i} \dot{P}_j + \sum_j \frac{P_j^m X_{ji}^m}{\Gamma_i P_i Q_i / \pi_i} \dot{P}_j^m + \sum_m \frac{W_{mi} (L_{mi}^P + L_{mi}^u)}{\Gamma_i P_i Q_i / \pi_i} \dot{W}_{mi} + \dot{\pi}_i - \dot{\Gamma}_i - \dot{P}_i, \quad i \in N, \quad (14)$$

Re-arranging this equation and substituting equation (12) - after

reclassification of the  $K_{ki}$  - gives us:

$$\sum_m \frac{W_{mi}(L_{mi}^P + L_{mi}^U)}{\Gamma_i P_i Q_i / \pi_i} \dot{W}_{mi} + \dot{\pi}_i = \dot{f}_i + \left( \sum_m \frac{W_{mi}(L_{mi}^P + L_{mi}^U)}{\Gamma_i P_i Q_i / \pi_i} \right) (\Gamma_i P_i) +$$

$$+ \left[ \frac{\sum_j (P_j X_{ji}^d + P_j^m X_{ji}^m)}{\Gamma_i P_i Q_i / \pi_i} \right] (\Gamma_i P_i) - \sum_j \frac{P_j X_{ji}^d}{\sum_j (P_j X_{ji}^d + P_j^m X_{ji}^m)} \dot{P}_j - \sum_j \frac{P_j^m X_{ji}^m}{\sum_j (P_j X_{ji}^d + P_j^m X_{ji}^m)} \dot{P}_j^m, \quad i \in N. \quad (15)$$

The second line of this equation represents the change in an industry's terms of trade. Thus, equation (15) indicates that, under competitive conditions, higher average production factor rewards in an industry can have three origins: a) higher productivity - to be estimated from equation (13), b) a higher (basic) output price - due to a higher producers' price or a lower indirect tax rate (i.e.  $\dot{\Gamma} > 0$ ), and c) an increase in the terms of trade.<sup>9</sup> It remains to be seen whether a different origin of an improvement in factor remunerations also has consequences for the distribution among factor types.<sup>10</sup>

Before we examine the allocation of these gains to various types of primary inputs, a further correction needs to be made in order to ensure that inputs and outputs are measured in the same units.

### 3. Correcting Input Volumes for Technical Change

Applying a total output growth accounting system brings into the open that volumes of various commodities appear twice: as output in one equation and as intermediate input in another. However, a certain input volume in year  $t$  is economically not equivalent to the same amount of output in that year.

Capital goods and intermediate commodities must have been produced before they can be used. In a situation of continuous technical progress, a producer therefore rather prefers a unit of his supplier's present output to an (unused) unit of output from the previous period.<sup>11</sup> In fact, since technical progress measures the difference between the output growth rate and the weighted average input growth rate (the input weights in equation (13) add to one), the equivalent volume growth rate of the current input of any commodity in another industry equals the growth rate of current output volume minus technical progress achieved in the meantime. So, in order to compare changes in the current output volume of a commodity and changes in the previously produced volume which is now used as input, the latter should be deflated by the current technical progress in the production activity which delivered it. Loosely speaking, if computers have become 5% more efficient this year, a 10% increase of today's types is equivalent to a 15% increase of last year's assortment.

This is the basic idea put forward by Read [1968] and elaborated by Rymes [1972, 1983]. Slightly different formulations can be found in Hulten [1978] and Peterson [1979]. The argument is intuitively most obvious in the case of capital goods. Realizing a certain output volume growth with the same old machines reflects more technical progress than increasing output by the same amount when that equipment had just been replaced, holding the change in all other inputs constant. In both examples, the number of machines used is the same.<sup>12</sup> Actually, employing better quality inputs or, in other words, more inputs, is an inherent part of the productivity change going on in the economy.<sup>13</sup> Rymes [1972] has shown that this corresponds to the Harrod-Robinson concept of technical change. After a correction of the (produced) input volumes for technical change,

the set of equations (13) becomes:

$$\begin{aligned} \dot{T}_i = \dot{Q}_i - \sum_j \frac{P_{ji} X_{ji}^d}{\Gamma_i P_i Q_i / \pi_i} (\dot{X}_{ji}^d - \dot{T}_j) - \sum_j \frac{P_{ji}^{m,m} X_{ji}^m}{\Gamma_i P_i Q_i / \pi_i} \dot{X}_{ji}^m - \sum_m \frac{W_{mi} L_{mi}^P}{\Gamma_i P_i Q_i / \pi_i} \dot{L}_{mi}^P - \\ - \sum_m \frac{W_{mi} L_{mi}^u}{\Gamma_i P_i Q_i / \pi_i} \dot{L}_{mi}^u, \quad i \in N, \end{aligned} \quad (16)$$

with  $\dot{T}$  = multifactor productivity change with corrected input volumes.<sup>14</sup>

An important characteristic of the above system is its interdependence: total domestic productivity change is determined simultaneously in all production activities, contrary to the set of equations (13). It goes without saying that technical progress is also occurring abroad. From the perspective of the national economy, imported goods and services have not been produced within the system; technical progress elsewhere is an exogenous impulse which accrues, in the first instance, to the importer of the product in which it is embodied. Besides, estimation of productivity change in foreign industries is an endless task. For these reasons, imported input volume changes have not been corrected for technical progress in the relevant (foreign) production activity - cf. equation (16).

Next, we give the relation between changes in factor incomes, the terms of trade and multifactor productivity for the case when input volumes are corrected for technical change:

$$\begin{aligned} \sum_m \frac{W_{mi} (L_{mi}^P + L_{mi}^u)}{\Gamma_i P_i Q_i / \pi_i} \dot{W}_{mi} + \dot{\pi}_i = (\dot{T}_i - \sum_j \frac{P_{ji} X_{ji}^d}{\Gamma_i P_i Q_i / \pi_i} \dot{T}_j) + \left\{ \frac{\sum_m W_{mi} (L_{mi}^P + L_{mi}^u)}{\Gamma_i P_i Q_i / \pi_i} \right\} (\dot{\Gamma}_i P_i) + \\ + \left[ \left\{ \frac{\sum_j P_{ji} X_{ji}^d + \sum_j P_{ji}^{m,m} X_{ji}^m}{\Gamma_i P_i Q_i / \pi_i} \right\} (\dot{\Gamma}_i P_i) - \sum_j \frac{P_{ji} X_{ji}^d}{\Gamma_i P_i Q_i / \pi_i} \dot{P}_j - \sum_j \frac{P_{ji}^{m,m} X_{ji}^m}{\Gamma_i P_i Q_i / \pi_i} \dot{P}_j^m \right], \quad i \in N. \end{aligned} \quad (17)$$

This rather lengthy introduction on methods of productivity measurement was required in order to trace the influences which determine the room for an increase in production factor remuneration rates. Now we turn to a more detailed study of the distributional implications.

#### 4. Distribution of the Fruits of Technical Progress

Within a Social Accounting Matrix, two stages are distinguished in the (primary) distribution of income. First, value added (at factor costs) accrues to the primary inputs. Subsequently, this income is appropriated by the institutional sectors. This slightly artificial bipartition is also followed here. So we start with indicating the room for an increase in factor rewards and then relate shifts in the household (primary) income distribution to the employment and earnings of each factor.

Regarding factor remunerations, our principal interest lies with the allocation over various labour types; so we first focus on changes in the average wage rate by industry and then turn to the adjustment of relative wage rates by labour category. In this analysis, productivity gains, output price rises, and changes in the industry terms of trade will be combined and dubbed changes in competitiveness ( $= \dot{\phi}_i$ ). Depending on the way productivity gains are computed, these changes in competitiveness are equal to the right-hand side of equation (15) or equation (17) above. In both cases we have that:

$$\dot{\phi}_i = \sum_m \frac{W_{mi} L_{mi}^P}{\Gamma_i P_i Q_i / \pi_i} \dot{W}_{mi} + \left[ \sum_m \frac{W_{mi} L_{mi}^U}{\Gamma_i P_i Q_i / \pi_i} \dot{W}_{mi} + \dot{\pi}_i \right], \quad i \in N. \quad (18)$$

The term in square brackets on the right-hand side of this equation accrues to the enterprise, in the first instance. However, it is not to be equated to net disposable income. Apart from the (net) payment of land rents, royalties and the like, it serves to pay interest on credits obtained and to settle direct taxes. In the case of a limited liability company, the shareholders then receive their dividends and the residual consists of net retained earnings. Management bonuses could here be considered as a kind of additional compensation for 'unpaid' labour input. In the case of an unincorporated firm, all unpaid workers (should) receive an (imputed) compensation for their labour input, and the net retained earnings are for the entrepreneur.

In a Social Accounting Matrix, both paid and unpaid labour categories

tend to be distinguished. Both major groups are then subdivided in the same way (e.g. by sex, education and occupation), and the imputed hourly wage of own-account workers is approximated by taking the remuneration rate of their employed colleagues with the same background characteristics working in the same industry (cf. Keuning [1985]). The SAM then shows the earnings of all groups of workers in two cross-tabulations: a) by industry and labour category, and b) by labour category and household group. Obviously, unpaid labour income largely accrues to households headed by self-employed persons.

The average wage rate in an industry ( $\bar{W}_i$ ) is affected by changes in wage rates by labour category and compositional shifts in the labour force:

$$\bar{W}_i = \sum_m \left( \frac{L_{mi}^P + L_{mi}^U}{\sum_m (L_{mi}^P + L_{mi}^U)} \right) W_{mi}, \quad i \in N, \quad (19)$$

and thus<sup>15</sup>

$$\begin{aligned} \dot{\bar{W}}_i = & \sum_m \left( \frac{W_{mi} L_{mi}^P}{\sum_m W_{mi} (L_{mi}^P + L_{mi}^U)} \right) \left( \dot{W}_{mi} + \left[ \frac{L_{mi}^P}{\sum_m (L_{mi}^P + L_{mi}^U)} \right] \right) + \\ & + \sum_m \left( \frac{W_{mi} L_{mi}^U}{\sum_m W_{mi} (L_{mi}^P + L_{mi}^U)} \right) \left( \dot{W}_{mi} + \left[ \frac{L_{mi}^U}{\sum_m (L_{mi}^P + L_{mi}^U)} \right] \right), \quad i \in N. \end{aligned} \quad (20)$$

Substituting (18) into (20) leads to a decomposition of changes in the average wage rate in each industry:

$$\begin{aligned} \dot{\bar{w}}_{.i} = & \left( \frac{\Gamma_i^P Q_i / \pi_i}{\sum_m W_{mi} (L_{mi}^P + L_{mi}^u)} \right) (\dot{\phi}_i - \dot{\pi}_i) + \sum_m \left( \frac{W_{mi} L_{mi}^P}{\sum_m W_{mi} (L_{mi}^P + L_{mi}^u)} \right) \left\{ \left[ \frac{L_{mi}^P}{\sum_m (L_{mi}^P + L_{mi}^u)} \right] \right\} + \\ & + \sum_m \left( \frac{W_{mi} L_{mi}^u}{\sum_m W_{mi} (L_{mi}^P + L_{mi}^u)} \right) \left\{ \left[ \frac{L_{mi}^u}{\sum_m (L_{mi}^P + L_{mi}^u)} \right] \right\}, \quad i \in N, \end{aligned} \quad (21)$$

Thus the increment in an industry's wage rate varies

- a) positively with changes in the industry's competitiveness and the more so when the share of the wage bill in total input costs before mark-up is lower,
- b) positively with a shift in the composition of the labour force towards better paid categories, and
- c) negatively with changes in the mark-up rate and the more so when the share of the wage bill in total input costs before mark-up is lower.

Analogously, a diverging trend in the remuneration of various categories of labour can be attributed to several factors. Starting from:

$$\bar{w}_{m.} = \sum_i \left( \frac{L_{mi}^P + L_{mi}^u}{\sum_i (L_{mi}^P + L_{mi}^u)} \right) W_{mi} = \sum_i \left( \frac{L_{mi}^P + L_{mi}^u}{\sum_i (L_{mi}^P + L_{mi}^u)} \right) (\bar{w}_{.i} * \left( \frac{W_{mi}}{\bar{w}_{.i}} \right)), \quad m \in M, \quad (22)$$

we derive:

$$\begin{aligned} \dot{\bar{w}}_{m.} = & \sum_i \left( \frac{W_{mi} (L_{mi}^P + L_{mi}^u)}{\sum_i W_{mi} (L_{mi}^P + L_{mi}^u)} \right) (\dot{\bar{w}}_{.i} + \left[ \frac{W_{mi}}{\bar{w}_{.i}} \right]) + \sum_i \left( \frac{W_{mi} L_{mi}^P}{\sum_i W_{mi} (L_{mi}^P + L_{mi}^u)} \right) \left\{ \left[ \frac{L_{mi}^P}{\sum_i (L_{mi}^P + L_{mi}^u)} \right] \right\} + \\ & + \sum_i \left( \frac{W_{mi} L_{mi}^u}{\sum_i W_{mi} (L_{mi}^P + L_{mi}^u)} \right) \left\{ \left[ \frac{L_{mi}^u}{\sum_i (L_{mi}^P + L_{mi}^u)} \right] \right\}, \quad m \in M. \end{aligned} \quad (23)$$

A certain group of labourers may have obtained above-average salary

increases because of:

- a) an over-representation in industries with high pay rises,
- b) higher wage rate advances than other groups in the same industries,  
and
- c) a shift to better paying industries.

The first-mentioned factor can be further decomposed, with the help of equation (21). Concerning the second factor, it might be interesting to find out whether the same category of labour improves its relative position in all industries, and, if not, whether there exists a correspondence between the type of labourers which gets the highest pay rise and the main factor leading to a salary increase in the industry concerned (productivity growth, terms of trade improvement, labour upgrading etc.).

It can be remarked that in empirical studies continuous data are not available, so that one has to work with discrete approximations or with index numbers. However, expressing time trends with the help of an index number implies that compositional changes are not taken into account. In this case, the use of index numbers is also not mandatory, since no aggregation problems exist. This is because: a) the unit in which labour is measured does not differ by labour category, and b) in principle all labourers are included in the (social) accounting framework. Therefore, a discrete formulation of the above equations is preferable. A good approximation can be found by computing growth rates as the difference from one period to the next in the natural logarithms of the variables, and calculating the weights as the arithmetic averages of the respective shares in time periods  $t$  and  $t-1$  (cf. Denny and Fuss [1983]).

The final stage of our investigations concerns the household (primary) income distribution. Now we must consider not only the remuneration rates of production factors provided by households, but also the employment of these factors. As explained earlier, we consider the (imputed) rental of own-account capital goods as a commodity-type service. Therefore, these inputs (roughly equal to depreciation costs) have been combined with the other intermediate inputs. Primary inputs thus consist of labour and non-produced capital. The mapping of these factor incomes to household groups

(H) and other institutional sectors (S-H) can be described as:<sup>16</sup>

$$\begin{aligned} & \sum_{im} W_{mi} (L_{mi}^P + L_{mi}^u) + \sum_i \mu_i \{ \sum_j P_j X_{ji}^d + \sum_j P_j^m X_{ji}^m + \sum_m W_{mi} (L_{mi}^P + L_{mi}^u) \} + \sum_m \bar{W}_m L_m^A + I^A = \\ & = \sum_{im} \bar{W}_m (L_{mi}^P + L_{mi}^u + L_m^A) + \sum_i (I_i + I^A) = \sum_{hm} \bar{W}_m (L_{mh}^P + L_{mh}^u) + \sum_s I_s = \sum_s Y_s, \quad (24) \end{aligned}$$

with<sup>17</sup>

- $L_m^A$  = employment of national border workers (labour category m) abroad minus domestic employment of foreign border workers (same category),
- $I^A$  = net returns on net direct investment abroad,
- $L_{mh}^P$  = employment of labour category m provided by household group h ( $h \in H \subset S$ ),
- $L_{mh}^u$  = self-employment of labour category m provided by household group h,
- $I_i$  = returns on non-produced capital services in production activity i,
- $I_s$  = returns on non-produced capital services provided by institutional sector s ( $s \in S$ ), and
- $Y_s$  = (primary) income of institutional sector s.

Further, for each household group the following equation holds:

$$\begin{aligned} \dot{Y}_h = & \sum_m \frac{\bar{W}_m L_{mh}^P}{\sum_m \bar{W}_m (L_{mh}^P + L_{mh}^u) + I_h} (\dot{\bar{W}}_m + \dot{L}_{mh}^P) + \sum_m \frac{\bar{W}_m L_{mh}^u}{\sum_m \bar{W}_m (L_{mh}^P + L_{mh}^u) + I_h} (\dot{\bar{W}}_m + \dot{L}_{mh}^u) + \\ & + \frac{I_h}{\sum_m \bar{W}_m (L_{mh}^P + L_{mh}^u) + I_h} \dot{I}_h, \quad h \in H. \quad (25) \end{aligned}$$

In turn,  $\dot{\bar{W}}_m$  can be further broken down with the help of equation (23) and equation (21) which may substitute  $\dot{\bar{W}}_i$  in (23). Finally,  $\dot{L}_{mh}^P$  and  $\dot{L}_{mh}^u$  can be related to demographic changes and developments in the labour force participation rate by household group.

With the help of equation (25), the relative importance of each factor contributing to a change in the primary income distribution can be established. The linkage between economic growth and concomitant

distributional changes becomes even clearer when equations (23) and (21) are substituted into (25). For instance, the framework presented in this paper allows for a separation of (primary) income distribution changes into a) the effects of differential growth rates (e.g. productivity gains by industry and shifts in the use of various types of labour by industry), and b) the effects of changes in relative unit value parameters (e.g. changes in the terms of trade, relative wage rates and mark-up rates by industry, and changes in relative wage rates by labour category).

## 5. Concluding Remarks

It goes without saying that the equations presented in this paper do not yet establish the direction of the causality which may exist between changes in productivity and industry terms of trade on the one hand and changes in the functional distribution of income on the other. Clearly, developments in the primary income distribution also do not tell everything about shifts in living standards or 'welfare'. Government intervention may alter the parameters of the secondary and tertiary income distribution. 'Real' income changes can only be computed if price and volume developments in the consumption basket of each household group are known (e.g. from comparison of two SAMs). Whether rising incomes and 'positive' distributional shifts can be interpreted as increases in national welfare, depends on the incorporation of possible changes in the balance of trade (cf. Diewert and Morrison [1986]). Finally, more aspects of welfare (e.g. asset possession, life expectancy, leisure) should be taken into account to arrive at an integrated, multi-dimensional analysis of inequality.

However, it is obvious that shifts in the primary income distribution are an important determinant of changes in inequality over time. This paper has related these shifts to structural adjustments in the economy (shifts in the input of resources and differential productivity changes) and to changes in relative prices (by industry and by factor of production). Once more insight is gained in the relative significance of these linkages in the past, perhaps more realistic behavioural assumptions can be formulated when exploring future trends in economic growth and income distribution.

Besides, the analysis in this paper may have some direct policy relevance. At the moment, predicted growth in average labour productivity is frequently used to judge, ex ante, the appropriateness of real wage rise demands in the private business sector. Apart from the question whether changes in the average product of labour can be equated with changes in the marginal product of labour (cf. equation (8) above and Panel to Review Productivity Statistics [1979]), separation of the

contribution of each input to total output does not make much sense anyway. This policy issue can better be addressed with the help of a multifactor productivity framework, supplemented by an idea about a reasonable (change in) the mark-up rate and by notions about expected shifts in the labour income share and in the (industry) terms of trade (cf. equation (18) above). Any desired improvement in non-market inputs, like work-place safety and environmental protection measures should then be taken into account as well.

## Notes

1. These issues are reviewed by Maddison [1987]. Another well-known source is Kendrick and Vaccara [1980]. The wider topic of technological change, that is shifts in input-output coefficients over time, is not covered in this paper (refer to e.g. Rose [1984] and Mark [1987]).
2. The Social Accounting Matrix (SAM) framework will be part of the revised System of National Accounts of the United Nations. An introduction to SAMs is provided by Pyatt and Round [1985] and by Keuning and de Ruijter [1988].
3. The superiority of the gross output concept for productivity measurement at the industry level is also substantiated by Capalbo and Denny [1986] and earlier by Gollop [1979]. Some of the consequences of excluding shifts in raw materials use from such an analysis are spelled out by Bruno [1984].
4. In practice, the so-called double-deflation method is usually applied to arrive at a constant price value added estimate. However, this means that value added is deflated by an output price index and not by an index built up from primary input price changes (cf. United Nations [1968: ch.4] and Schimmler [1983]).
5. An example may serve to illustrate this point. Suppose that an incorporated company rents all capital goods needed in the production process. Consequently, there is no capital stock in this firm and the remuneration of this capital input is already recorded as intermediate input costs (namely the purchase of business services). Nevertheless, that does certainly not imply that operating surplus will be equal to zero as well.
6. This means that an increase in the utilization rate of capital is considered as productivity growth. In our view, deterioration of capital stock which remains idle is still to be seen as an input cost and a more intensive use implies an efficiency improvement.

7. In principle, land use could also be included into this list of inputs, provided that land can be classified according to various categories which fetch a roughly uniform price.
8. In a sufficiently detailed intermediate input block, these cells were originally all empty since capital goods are only delivered to final demand. Therefore, homogeneity is not disturbed if depreciation costs are moved to this intermediate input block.
9. At the national level, Diewert and Morrison [1986] have also shown that "... an increase in the price of exports relative to imports has an effect that is similar to an increase in total factor productivity" (p.659). Refer also to Jorgenson and Fraumeni [1981].
10. If we perform the analysis from the viewpoint of the entrepreneur, labour inputs are considered as a cost factor. Notice that, if the change in the average wage rate by industry is moved to the right-hand side of equation (15), a higher mark-up rate can be directly related to a) an increase in productivity, and b) an improvement of the industry terms of trade with respect to both labour inputs and intermediate inputs.
11. Technical progress should thus be interpreted in a broad sense as a general preference today for the product characteristics of today. This phenomenon nowadays plays an ever increasing role in consumer demand, which has permeated through the market for intermediate commodities.
12. If the technical lifetime of the old and new machines is the same, and there is no intrinsic reason why that should not be the case, the actual amount of capital used up does not change either. Moreover, an increase in the (rental) price of capital goods always implies the same higher price of (produced) capital input, irrespective of the age of the assets in use. Notice, however, that faster technical progress in the machinery producing sector will cause faster economic deterioration of the

machines currently in use. This is precisely the reason why the growth in current input volume of machinery rental services has to be "deflated" by that technical progress.

13. Denison [1989: 30-31] states that he is now inclined to regard this method as preferable for measuring capital input in growth analysis. He gives another example: "Suppose new knowledge permits more capital goods, unchanged in design, to be produced with no increase in the amounts of labor, capital, or land used in their production. The usual procedure will show the capital stock increasing as the extra capital goods enter the stock and will credit capital (and total input) with the resulting gains in national product. This occurs even though the increases in output per unit of input in producing capital goods result from advances in knowledge, not from saving in the fundamental sense of consumption foregone".
14. A fully correct application of this correction of input volumes would require that base-year capital stocks which consist of various vintages are converted into the efficiency of the base-year output of capital goods. This results in smaller base-year volumes (if efficiency has increased over time) and thus in larger growth rates of produced capital input. As a consequence, productivity changes would be smaller in that case (refer also to Durand and Salem [1989]). This discrepancy will gradually vanish once we start to compute the 'correct' productivity changes and use these to adjust the additions to capital stock which have taken place since the original base-year.
15. A similar decomposition is applied by Leslie [1985].
16. The formulation in equation (24) presupposes that the underlying data framework is a (two-dimensional) Social Accounting Matrix. As a consequence, value added generated in each industry is allocated to households through the incomes of production factors and no direct information is available on the production activities in which each household group is engaged. Whereas the assumption of an equal remuneration rate of each labour category for all household groups

seems sufficiently plausible, the analogous assumption with respect to the returns on (non-produced) capital input is more dubious. A very relevant classification of these capital services is precisely by production activity in which the investment was made, and particularly in developing countries many household groups tend to concentrate their assets in specific production activities (e.g. farming, trade etc.). This shortcoming is remedied if value added is shown in a three-dimensional table: institutional sectors \* factors of production \* production activities.

17. For the moment, it has been assumed that the remuneration rate earned by each type of labourer abroad is identical to the domestic average.

## References

- Bruno, M., 1984, "Raw Materials, Profits and the Productivity Slowdown". *Quarterly Journal of Economics*, Vol.99, No.1.
- Capalbo, S.M. and M.G.S. Denny, 1986, "Testing Long-Run Productivity Models for Canadian and U.S. Agricultural Sectors". *American Journal of Agricultural Economy*, Vol.68, August.
- Denison, E.F., 1989, *Estimates of Productivity Change by Industry: An Evaluation and an Alternative*, (The Brookings Institution, Washington D.C.).
- Denny, M. and M. Fuss, 1983, "The Use of Discrete Variables in Superlative Index Number Comparisons". *International Economic Review*, Vol.24, No. 2.
- Diewert, W.E. and C.J. Morrison, 1986, "Adjusting Output and Productivity Indexes for Changes in the Terms of Trade". *Economic Journal*, Vol. 96, No. 383.
- Durand, R. and M. Salem, 1989, *Alternative Measures of Productivity Growth in a Rectangular Input-Output Framework*, mimeo, (Statistics Canada, Ottawa).
- Fischer, G., K. Frohberg, M.A. Keyzer and K.S. Parikh, 1988, *Linked National Models: A Tool for International Food Policy Analysis*, (Kluwer Academic Publishers, Dordrecht).
- Gollop, F.M., 1979, "Accounting for Intermediate Input: The Link between Sectoral and Aggregate Measures of Productivity Growth". Panel to Review Productivity Statistics, *Measurement and Interpretation of Productivity*, (National Academy of Sciences, Washington D.C.).
- Hulten, C.R., 1978, "Growth Accounting with Intermediate Inputs". *The Review of Economic Studies*, Vol.45, No.3.
- Jorgenson, D.W. and B.M. Fraumeni, 1981, "Relative Prices and Technical Change". E.R. Berndt and B.C. Field (eds.), *Modeling and Measuring Natural Resource Substitution*, (MIT Press, Cambridge, Mass.).
- Kendrick, J.W. and B.N. Vaccara (eds.), 1980, *New Developments in Productivity Measurement and Analysis*, (University of Chicago Press, Chicago).
- Keuning, S.J., 1985, 'Segmented Development and the Way Profits Go: The Case of Indonesia'. *The Review of Income and Wealth*, Vol. 31, No. 4.

- Keuning, S.J. and W.A. de Ruijter, 1988, 'Guidelines to the Construction of a Social Accounting Matrix'. *The Review of Income and Wealth*, Vol. 34, No. 1.
- Leslie, D., 1985, "Real Wage Growth, Technical Change and Competition in the Labor Market". *The Review of Economics and Statistics*, Vol.67, No.4.
- Maddison, A., 1987, "Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment". *Journal of Economic Literature*, Vol.25, No.2.
- Mark, J.A., 1987, "Technological Change and Employment: Some Results from BLS Research". *Monthly Labor Review*, April.
- Panel to Review Productivity Statistics, 1979, *Measurement and Interpretation of Productivity*, (Academy of Sciences, Washington D.C.).
- Peterson, W., 1979, "Total Factor Productivity in the UK: A Disaggregated Analysis". K.D. Patterson and K. Schott (eds.), *The Measurement of Capital*, (Mac Millan Press, London).
- Pyatt, G. and J.I. Round (eds.), *Social Accounting Matrices: A Basis for Planning*, (The World Bank, Washington D.C.).
- Read, L.M., 1968, "The Measure of Total Factor Productivity Appropriate to Wage-Price Guidelines". *Canadian Journal of Economics*, Vol.1, No.2.
- Rose, A., 1984, "Technological Change and Input-Output Analysis: An Appraisal" . *Socio-Economic Planning Sciences*, Vol.18, No.5.
- Rymes, T.K., 1972, "The Measurement of Capital and Total Factor Productivity in the Context of the Cambridge Theory of Capital". *The Review of Income and Wealth*, Vol.18, No.1.
- Rymes, T.K., 1983, "More on the Measurement of Total Factor Productivity". *The Review of Income and Wealth*, Vol.29, No.3.
- Rymes, T.K., 1986, "The Measurement of Multifactor Productivity in an Input-Output Framework: New Canadian Estimates". A. Franz and N. Rainer (eds.), *Problems of Compilation of Input-Output Tables*, (Orac-Verlag, Wien).

- Schimmler, H. 1983, "Some Conceptual Dilemmas in the Use of Present National Accounts". *The Review of Income and Wealth*, Vol.29, No.3.
- United Nations, 1968, *A System of National Accounts*, Studies in Methods, Series F, No.2, Rev.3, (United Nations, New York).
- Van Bochove, C.A. and H.K. van Tuinen, 1986, "Flexibility in the Next SNA: The Case for an Institutional Core". *The Review of Income and Wealth*, Vol.32, No.2.

## National Accounts Occasional Papers

- NA/01 **Flexibility in the system of National Accounts**, Van Eck, R., C.N. Gorter and H.K. van Tuinen (1983).  
This paper sets out some of the main ideas of what gradually developed into the Dutch view on the fourth revision of the SNA. In particular it focuses on the validity and even desirability of the inclusion of a number of carefully chosen alternative definitions in the "Blue Book", and the organization of a flexible system starting from a core that is easier to understand than the 1968 SNA.
- NA/02 **The unobserved economy and the National Accounts in the Netherlands, a sensitivity analysis**, Broesterhuizen, G.A.A.M. (1983).  
This paper studies the influence of fraud on macro-economic statistics, especially GDP. The term "fraud" is used as meaning unreporting or underreporting income (e.g. to the tax authorities). The conclusion of the analysis of growth figures is that a bias in the growth of GDP of more than 0.5% is very unlikely.
- NA/03 **Secondary activities and the National Accounts: Aspects of the Dutch measurement practice and its effects on the unofficial economy**, Van Eck, R. (1985).  
In the process of estimating national product and other variables in the National Accounts a number of methods is used to obtain initial estimates for each economic activity. These methods are described and for each method various possibilities for distortion are considered.
- NA/04 **Comparability of input-output tables in time**, Al, P.G. and G.A.A.M. Broesterhuizen (1985).  
It is argued that the comparability in time of statistics, and input-output tables in particular, can be filled in in various ways. The way in which it is filled depends on the structure and object of the statistics concerned. In this respect it is important to differentiate between coordinated input-output tables, in which groups of units (industries) are divided into rows and columns, and analytical input-output tables, in which the rows and columns refer to homogeneous activities.
- NA/05 **The use of chain indices for deflating the National Accounts**, Al, P.G., B.M. Balk, S. de Boer and G.P. den Bakker (1985).  
This paper is devoted to the problem of deflating National Accounts and input-output tables. This problem is approached from the theoretical as well as from the practical side. Although the theoretical argument favors the use of chained Vartia-I indices, the current practice of compiling National Accounts restricts to using chained Paasche and Laspeyres indices. Various possible objections to the use of chained indices are discussed and rejected.
- NA/06 **Revision of the system of National Accounts: the case for flexibility**, Van Bochove, C.A. and H.K. van Tuinen (1985).  
It is argued that the structure of the SNA should be made more flexible. This can be achieved by means of a system of a general purpose core supplemented with special modules. This core is a fully fledged, detailed system of National Accounts with a greater institutional content than the present SNA and a more elaborate description of the economy at the meso-level. The modules are more analytic and reflect special purposes and specific theoretical views. It is argued that future revisions will concentrate on the modules and that the core is more durable than systems like present SNA.
- NA/07 **Integration of input-output tables and sector accounts; a possible solution**, Van den Bos, C. (1985).  
The establishment-enterprise problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation. An adapted sectoring of institutional units is proposed for the construction of input-output tables.

- NA/08 A note on Dutch National Accounting data 1900-1984, Van Bochove, C.A. (1985).  
This note provides a brief survey of Dutch national accounting data for 1900-1984, concentrating on national income. It indicates where these data can be found and what the major discontinuities are. The note concludes that estimates of the level of national income may contain inaccuracies; that its growth rate is measured accurately for the period since 1948; and that the real income growth rate series for 1900-1984 may contain a systematic bias.
- NA/09 The structure of the next SNA: review of the basic options, Van Bochove, C.A. and A.M. Bloem (1985).  
There are two basic issues with respect to the structure of the next version the UN System of National Accounts. The first is its 'size': reviewing this issue, it can be concluded that the next SNA must be 'large' in the sense of containing an integrated meso-economic statistical system. It is essential that the next SNA contains an institutional system without the imputations and attributions that pollute present SNA. This can be achieved by distinguishing, in the central system of the next SNA, a core (the institutional system), a standard module for non-market production and a standard module describing attributed income and consumption of the household sector.
- NA/10 Dual sectoring in National Accounts, Al, P.G. (1985).  
Following a conceptual explanation of dual sectoring, an outline is given of a statistical system with complete dual sectoring in which the linkages are also defined and worked out. It is shown that the SNA 1968 is incomplete and obscure with respect to the links between the two sub-processes.
- NA/11 Backward and forward linkages with an application to the Dutch agro-industrial complex, Harthoorn, R. (1985).  
Some industries induce production in other industries. An elegant method is developed for calculating forward and backward linkages avoiding double counting. For 1981 these methods have been applied to determine the influence of Dutch agriculture in the Dutch economy in terms of value added and labour force.
- NA/12 Production chains, Harthoorn, R. (1986).  
This paper introduces the notion of production chains as a measure of the hierarchy of industries in the production process. Production chains are sequences of transformation of products by successive industries. It is possible to calculate forward transformations as well as backward ones.
- NA/13 The simultaneous compilation of current price and deflated input-output tables, De Boer, S. and G.A.A.M. Broesterhuizen (1986).  
A few years ago the method of compiling input-output tables underwent in the Netherlands an essential revision. The most significant improvement is that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.
- NA/14 A proposal for the synoptic structure of the next SNA, Al, P.G. and C.A. van Bochove (1986).
- NA/15 Features of the hidden economy in the Netherlands, Van Eck, R. and B. Kazemier (1986).  
This paper presents survey results on the size and structure of the hidden labour market in the Netherlands.
- NA/16 Uncovering hidden income distributions: the Dutch approach, Van Bochove, C.A. (1987).
- NA/17 Main national accounting series 1900-1986, Van Bochove, C.A. and T.A. Huitker (1987).  
The main national accounting series for the Netherlands, 1900-1986, are provided, along with a brief explanation.

- NA/18 The Dutch economy, 1921-1939 and 1969-1985. A comparison based on revised macro-economic data for the interwar period, Den Bakker, G.P., T.A. Huitker and C.A. van Bochove (1987).  
A set of macro-economic time series for the Netherlands 1921-1939 is presented. The new series differ considerably from the data that had been published before. They are also more comprehensive, more detailed, and conceptually consistent with the modern National Accounts. The macro-economic developments that are shown by the new series are discussed. It turns out that the traditional economic-historical view of the Dutch economy has to be reversed.
- NA/19 Constant wealth national income: accounting for war damage with an application to the Netherlands, 1940-1945, Van Bochove, C.A. and W. van Sorge (1987).
- NA/20 The micro-meso-macro linkage for business in an SNA-compatible system of economic statistics, Van Bochove, C.A. (1987).
- NA/21 Micro-macro link for government, Bloem, A.M. (1987).  
This paper describes the way the link between the statistics on government finance and national accounts is provided for in the Dutch government finance statistics.
- NA/22 Some extensions of the static open Leontief model, Harthoorn, R. (1987).  
The results of input-output analysis are invariant for a transformation of the system of units. Such transformation can be used to derive the Leontief price model, for forecasting input-output tables and for the calculation of cumulative factor costs. Finally the series expansion of the Leontief inverse is used to describe how certain economic processes are spread out over time.
- NA/23 Compilation of household sector accounts in the Netherlands National Accounts, Van der Laan, P. (1987).  
This paper provides a concise description of the way in which household sector accounts are compiled within the Netherlands National Accounts. Special attention is paid to differences with the recommendations in the United Nations System of National Accounts (SNA).
- NA/24 On the adjustment of tables with Lagrange multipliers, Harthoorn, R. and J. van Dalen (1987).  
An efficient variant of the Lagrange method is given, which uses no more computer time and central memory than the widely used RAS method. Also some special cases are discussed: the adjustment of row sums and column sums, additional restraints, mutual connections between tables and three dimensional tables.
- NA/25 The methodology of the Dutch system of quarterly accounts, Janssen, R.J.A. and S.B. Algera (1988).  
In this paper a description is given of the Dutch system of quarterly national accounts. The backbone of the method is the compilation of a quarterly input-output table by integrating short-term economic statistics.
- NA/26 Imputations and re-routeings in the National Accounts, Gorter, Cor N. (1988).  
Starting out from a definition of 'actual' transactions an inventory of all imputations and re-routeings in the SNA is made. It is discussed which of those should be retained in the core of a flexible system of National Accounts. Conceptual and practical questions of presentation are brought up. Numerical examples are given.
- NA/27 Registration of trade in services and market valuation of imports and exports in the National Accounts, Bos, Frits (1988).  
The registration of external trade transactions in the main tables of the National Accounts should be based on invoice value; this is not only conceptually very attractive, but also suitable for data collection purposes.
- NA/28 The institutional sector classification, Van den Bos, C. (1988).  
A background paper on the conceptual side of the grouping of financing units. A limited number of criteria are formulated.

- NA/29 The concept of (transactor-)units in the National Accounts and in the basic system of economic statistics, Bloem, Adriaan M. (1989). Units in legal-administrative reality are often not suitable as statistical units in describing economic processes. Some transformation of legal-administrative units into economic statistical units is needed. This paper examines this transformation and furnishes definitions of economic statistical units. Proper definitions are especially important because of the forthcoming revision of the SNA.
- NA/30 Regional income concepts, Bloem, Adriaan M. and Bas De Vet (1989). In this paper, the conceptual and statistical problems involved in the regionalization of national accounting variables are discussed. Examples are the regionalization of Gross Domestic Product, Gross National Income, Disposable National Income and Total Income of the Population.
- NA/31 The use of tendency surveys in extrapolating National Accounts, Ouddeken, Frank and Gerrit Zijlmans (1989). This paper discusses the feasibility of the use of tendency survey data in the compilation of very timely Quarterly Accounts. Some preliminary estimates of relations between tendency survey data and regular Quarterly Accounts-indicators are also presented.
- NA/32 An economic core system and the socio-economic accounts module for the Netherlands, Gorter, Cor N. and Paul van der Laan (1989). A discussion of the core and various types of modules in an overall system of economy related statistics. Special attention is paid to the Dutch Socio-economic Accounts. Tables and figures for the Netherlands are added.
- NA/33 A systems view on concepts of income in the National Accounts, Bos, Frits (1989). In this paper, concepts of income are explicitly linked to the purposes of use and to actual circumstances. Main choices in defining income are presented in a general system. The National Accounts is a multi-purpose framework. It should therefore contain several concepts of income, e.g. differing with respect to the production boundary. Furthermore, concepts of national income do not necessarily constitute an aggregation of income at a micro-level.
- NA/34 How to treat borrowing and leasing in the next SNA, Keuning, Steven J. (1990). The use of services related to borrowing money, leasing capital goods, and renting land should not be considered as intermediate inputs into specific production processes. It is argued that the way of recording the use of financial services in the present SNA should remain largely intact.
- NA/35 A summary description of sources and methods used in compiling the final estimates of Dutch National Income 1986, Gorter, Cor N. and others (1990). Translation of the inventory report submitted to the GNP Management Committee of the European Communities.
- NA/36 The registration of processing in make and use tables and input-output tables, Bloem, Adriaan M., Sake De Boer and Pieter Wind (1990, forthcoming). The registration of processing is discussed primarily with regard to its effects on input-output-type tables and input-output quotes. Links between National Accounts and basic statistics, user demands and international guidelines are examined.
- NA/37 A proposal for a SAM which fits into the next System of National Accounts, Keuning, Steven J. (1990). This paper shows that all flow accounts which may become part of the next System of National Accounts can be embedded easily in a Social Accounting Matrix (SAM). In fact, for many purposes a SAM format may be preferred to the traditional T-accounts for the institutional sectors, since it allows for more flexibility in selecting relevant classifications and valuation principles.
- NA/38 Net versus gross National Income, Bos, Frits (1990). In practice, gross figures of Domestic Product, National Product and National Income are most often preferred to net figures. In this paper, this practice is challenged. Conceptual issues and the reliability of capital consumption estimates are discussed.

- NA/39 Concealed interest income of households in the Netherlands; 1977, 1979 and 1981, Kazemier, Brugt (1990).  
The major problem in estimating the size of hidden income is that total income, reported plus unreported, is unknown. However, this is not the case with total interest income of households in the Netherlands. This makes it possible to estimate at least the order of magnitude of this part of hidden income. In this paper it will be shown that in 1977, 1979 and 1981 almost 50% of total interest received by households was concealed.
- NA/40 Who came off worst: Structural change of Dutch value added and employment during the interwar period, Den Bakker, Gert P. and Jan de Gijt (1990).  
In this paper new data for the interwar period are presented. The distribution of value added over industries and a break-down of value added into components is given. Employment by industry is estimated as well. Moreover, structural changes during the interwar years and in the more recent past are juxtaposed.
- NA/41 The supply of hidden labour in the Netherlands: a model, Brugt Kazemier and Rob van Eck (1990).  
This paper presents a model of the supply of hidden labour in the Netherlands. Model simulations show that the supply of hidden labour is not very sensitive to cyclical fluctuations. A tax exempt of 1500 guilders for second jobs and a higher probability of detection, however, may substantially decrease the magnitude of the hidden labour market.
- NA/42 Benefits from productivity growth and the distribution of income, Keuning, Steven J. (1990).  
This paper contains a discussion on the measurement of multifactor productivity and sketches a framework for analyzing the relation between productivity changes and changes in the average factor remuneration rate by industry. Subsequently, the effects on the average wage rate by labour category and the household primary income distribution are studied.

-----

Netherlands Central Bureau of Statistics  
National Accounts Department  
Occasional Papers

Please send me the following paper(s): .....

.....

Name: .....

Address: .....

Country: .....

Organization: .....

Return to: CBS, National Accounts Department  
P.O. Box 959  
2270 AZ Voorburg  
The Netherlands

-----

