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# PRODUCTIVITY MEASUREMENT AT STATISTICS NETHERLANDS: A PROGRESS REPORT

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## 1. Introduction

In 2007 the National Accounts of the Netherlands will be expanded with a set of total factor productivity (TFP) statistics. Our main goal is to construct a system of productivity statistics at the industry branch and macro level that is, to the extent possible, consistent with National Accounts statistics. A second requirement we want to impose on our growth accounting framework is that our system should not depend on a particular school of thought about the functioning of an economy. In particular we do not adopt the neo-classical production framework. As a result TFP change is not necessarily interpreted as exclusively the result of technological change, but may also be due to scale effects, efficiency improvements and other factors.

On the basis of these two principles, this report presents a tentative growth accounting framework for the Netherlands and a number of preliminary results. A range of sensitivity analyses were carried out to investigate the effects of various assumptions on productivity statistics on the industry and macro level. These assumptions refer among other things to determining a return to capital and the labour income of the self-employed. At this stage, none of the assumptions made in this paper are a final choice.

Section 2 of this paper sketches the main principles of our growth accounting system. Sections 3 and 4 discuss the issue of capital and labour input measurement at current and constant prices. The other inputs of production are discussed in section 5. Sensitivity analyses are being presented in section 6. Section 7 addresses the relationship between gross output and value added based TFP change. Section 8 winds up with conclusions and indicates directions for future work.

## 2. Measuring productivity change

For any production unit (be it an enterprise or an industry) productivity change is generically defined as output quantity change relative to input quantity change. Expressing change by index numbers, a productivity index is defined as an output quantity index divided by an input quantity index. For this to be operational, one has to decide on what is seen as output and what is seen as input. And this in turn depends on the production model chosen. Two models are particularly important.

The first model stays closest to the actual (physical) production process. Output represents the supply of all the goods and/or services that are being produced. This is also called ‘gross output’. The input, then, is the consumption of all the goods and services that are necessary for the production. The various items are usually classified into the groups: capital (K), labour (L), energy (E), materials (M), and services (S). The items belonging to groups K and L are called primary input factors, and those belonging to groups E, M, and S are called intermediate input factors.

In this model, a total factor productivity (TFP) index is defined as a quantity index of gross output divided by a quantity index of combined KLEMS input. A single factor productivity index, such as a labour productivity (LP) index, is defined as a quantity index of gross output divided by a quantity index of labour (L) input. A multi-factor productivity index is obviously something in between.

The second model is more economically oriented. As output is seen the gross output minus the intermediate inputs that are used in the production process. This is called the 'value added output' concept. Value added is defined as revenue (= value of gross output) minus intermediate input cost (= cost of EMS inputs). Notice that, in contradistinction to gross output, there are no well-defined output quantities related to value added. What can be done, however, is decompose the change of value added through time into a price and a quantity component. Expressing change by index numbers, the quantity index of value added is the output quantity index sought.

In this model, there are but two groups of inputs, namely K and L. Hence, a TFP index is defined as a quantity index of value added divided by a quantity index of combined KL input. Similarly, a LP index is defined as a quantity index of value added divided by a quantity index of labour (L) input.

Can anything be said about the relation between a gross-output based TFP index and a value-added based TFP index? Balk (2003b) showed that under the assumption that total cost is equal to gross output (so that there is no profit), for a fairly large class of index formulas, value-added based TFP change (expressed as a percentage) is larger than gross-output based TFP change, the factor of proportionality being given by the ratio of gross output to value added (the so-called Domar factor).[1]

Finally, there is a generic relation between productivity measurement and growth accounting. Recall that a productivity index is defined as an output quantity index divided by an input quantity index. This relation can also be expressed as: output quantity index = productivity index times input quantity index. After transforming index numbers into percentages, one gets a familiar type of growth accounting relation: output quantity change = productivity change + input quantity change. This relation provides the well-known interpretation of productivity change as the unexplained (namely by input quantity change), or residual, part of output quantity change. Of course, depending on the type of productivity index the relation can take on more complicated forms.

It is important, however, to be fully aware of the fact that in the growth accounting relation the two right-hand side factors, productivity change and input quantity change, are not independent, since productivity change is *defined* as the residual between output quantity change and input quantity change. Put otherwise, productivity change cannot be seen as a separately operating force in the production

[1] For a derivation of this result under the usual neo-classical assumptions see Jorgenson, Ho and Stiroh (2005), p. 298.

process. More insight can only be obtained when one is prepared to make (far-reaching) assumptions on the structure of the production process and the 'behaviour' of the production unit under consideration (see Balk 2003a).

### 2.1 Choice of index formula

For the calculation of aggregate quantity or volume change of inputs and outputs, an index formula must be selected. In the standard growth accounting approach the index formula corresponds to a certain specification of the production function and TFP change represents technological change. However, such an approach depends on strong (neo-classical) assumptions, for instance that production processes are subject to constant returns to scale and that there is perfect competition.[2] We don't wish to make such strong assumptions, and prefer to select an index formula on the basis of its properties.

Common indices, in the context of productivity measurement, are the Laspeyres index, the Törnqvist index and the Fisher index. Because of their different properties, the selection of a specific index is not inconsequential. Balk (1995) reviews the various indices and their properties.

For the annual publication of productivity statistics, for the time being chained Laspeyres volume index numbers will be used. The reasons are twofold. First, convenience of calculation, given the set-up of the Netherlands' supply and use tables. Second, consistency with the volume index numbers as published in the National Accounts. However, future work will be directed to the use of alternative index formulas and the sensitivity of the results due to the formulas used.

Generically, the Laspeyres volume index for period t relative to period t-1 is defined by

$$Q_L^t \equiv \frac{\sum_i p_i^{t-1} q_i^t}{\sum_i p_i^{t-1} q_i^{t-1}}, \qquad (1)$$

where $q_i^t$ denotes the quantity of commodity i in year t and $p_i^t$ its unit price. Then, $p_i^t q_i^t$ is the value of commodity i in year t at current prices and $p_i^{t-1} q_i^t$ is the value in prices of the previous year. For labour these values are given by total compensation of employees (in current prices and in prices of the previous year), whereas for capital they are given by the user cost of capital.

Assuming that quantities in year t-1 are non-zero, expression (1) can be rewritten as

[2] See Jorgenson, Ho and Stiroh (2005), e.g. p. 37.

$$Q_L^t = \frac{\sum_i p_i^{t-1} q_i^t}{\sum_i p_i^{t-1} q_i^{t-1}} = \frac{\sum_i p_i^{t-1} q_i^{t-1} \frac{q_i^t}{q_i^{t-1}}}{\sum_i p_i^{t-1} q_i^{t-1}} = \sum_i \frac{p_i^{t-1} q_i^{t-1}}{\sum_i p_i^{t-1} q_i^{t-1}} \frac{q_i^t}{q_i^{t-1}} \equiv \sum_i s_i^{t-1} \frac{q_i^t}{q_i^{t-1}} \quad , \quad (2)$$

where $s_i^{t-1}$ is the share of commodity i in the total value in year t-1. Though this is the operational form of the Laspeyres index that is generally used, it appears that the set-up of the supply and use tables makes it easier to work directly with expression (1). This form has also distinct advantages when it comes to (des-) aggregation.

### 2.2 Aggregation

Aggregation means that smaller production units are joined to larger units, e.g. enterprises to industry branches, or industry branches to sectors of the economy. Aggregation, however, is more than simple addition. In order that an aggregate of smaller units can be considered as a single big unit, all supply and use streams between the smaller units must be netted out. This netting-out is also called consolidation.

Aggregation has important consequences for productivity indices. This can be seen as follows. First, gross output of the big unit is less than the sum of the gross output of the smaller units, since all the mutual deliveries between the smaller units must be subtracted. Second, while the K and L input of the big unit is a simple sum of the K and L input of the small units (since K and L are unique to the units), the intermediate EMS consumption of the big unit is less than the sum of the EMS consumption of the small units. Since smaller input and/or output quantities imply nothing about the relative magnitude of quantity *changes*, it may safely be concluded that there is no simple relation between a gross-output based TFP index number of the big unit and the gross-output based TFP index numbers of the small units.

Consider now a value-added based TFP index. Value added of the big unit is a simple sum of value added of the smaller units, and K and L input of the big unit is a simple sum of K and L input of the small units. Put otherwise, by using the value added concept, the small units are considered to be disjunct; that is, relations of supply and use do not exist between them. This implies that there is a simple relation between the TFP index number of the big unit and those of the small units. In fact, TFP change (expressed as a percentage) of the big unit can be expressed as a weighted arithmetic average of TFP change of the small units.

As mentioned previously, Balk (2003b) showed that under the assumption that total cost is equal to gross output (so that there is no profit), for a fairly large class of index formulas, value-added based TFP change (expressed as a percentage) is larger than gross-output based TFP change, the factor of proportionality being given by the ratio of gross output to value added (the so-called Domar factor). It is not obvious

what will happen when the assumption about the equality of cost and gross output is dropped. Some empirical evidence will be presented in chapter 7.

In any case, the higher the level of aggregation the lesser difference there will be between value added and gross output, and thus the lesser difference between the two TFP measures.

## 3. Capital inputs

Production usually requires capital assets (buildings, machinery, tools, etcetera). Apart from new investments, which can happen anytime during a bookkeeping period (year), these assets are available at the start of the period and, apart from wear and tear, are still available at the end of the period. The user cost of capital is the cost of using these assets during a year. The user cost is the counterpart of leasing assets, and should therefore be comparable to rental prices of such assets. The user cost of capital comprises three components:

1) The revaluation of the assets during the year. This revaluation is equal to the value of the assets at the beginning of the year less their value at the end of the year. Usually capital goods are subject to a reduction in value over time, but some assets, e.g. dwellings, might increase in value over time.

2) The imputed cost of the money that is tied up in the assets.

3) The sum of all taxes less subsidies that the government levies on owning certain assets.

For any industry and institutional sector, the end of period user cost for a certain quantity of assets of type[3] i and age[4] j, which is available at the start of the year, is calculated as

$$U^{*t}_{i,j} \equiv (1 + r^{t+,t-})P^{t-}_{i,j-0.5}K^{t-}_{i,j-0.5} - P^{t+}_{i,j+0.5}K^{t+}_{i,j+0.5} + T^{t}_{K,i,j} \equiv U^{t}_{i,j} + T^{t}_{K,i,j} \ , \qquad (3)$$

where t denotes the period $[t_-, t_+]$, $t_- = (t-1)_+$ and $t_+ = (t+1)_-$; hereafter t will also be used to indicate the midpoint of the period;

$r^{t+,t-}$ denotes the (nominal) discount rate over the period $[t_-, t_+]$;

$P^{t-}_{i,j-0.5}$ denotes the price of an asset of age j-0.5 at time $t_-$;

$K^{t-}_{i,j-0.5}$ denotes the quantity of assets of age j-0.5 at time $t_-$;

$T^{t}_{K,i,j}$ denotes the sum of taxes less subsidies on the assets of age j in year t;

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[3] For the calculation of the user cost 60 industries, 18 institutional sectors and 20 assets are distinguished.

[4] Since it is assumed that investments are made halfway a year, the age of an asset at the beginning or end of a year is always j ± 0.5 year.

$U^t_{i,j}$ denotes the user cost excluding taxes less subsidies on assets of age j in year t.

Usually, it is not possible to determine the sum of taxes less subsidies for individual assets. For some taxes, such as road tax, it is possible to attribute the tax to a specific asset type, but generally taxes less subsidies are only known at the level of an industry, not specified by asset type. In practice, taxes less subsidies are therefore added to the user cost at a higher aggregation level.

The allocation of taxes less subsidies is addressed in section 5.2. In the remainder of this chapter, taxes less subsidies will be excluded from the user cost. Furthermore, the subscript i will be dropped in order to simplify the expressions.

A detailed theoretical derivation of the user cost (excluding taxes less subsidies) is given by Balk and van den Bergen (2006). The same framework will be used here.

In the Dutch Perpetual Inventory Method (PIM) it is assumed that trade in second-hand assets and other volume changes only occur at the end of a year. The quantity of capital can therefore assumed as being constant during a year. This implies that expression (3) can be restated as

$$U^t_j \equiv (1 + r^{t+,t-})P^{t-}_{j-0.5}K^t_j - P^{t+}_{j+0.5}K^t_j \ . \tag{4}$$

With the user cost per unit of capital defined as

$$u^t_j \equiv \frac{U^t_j}{K^t_j} = (1 + r^{t+,t-})P^{t-}_{j-0.5} - P^{t+}_{j+0.5} \ , \tag{5}$$

the total user cost can be expressed as

$$U^t = \sum_{j=1}^{\infty} \frac{u^t_j}{P^t_{j-0.5}} \left[ \frac{P^t_{j-0.5}}{P^{t-1}_{j-0.5}} P^{t-1}_{j-0.5} K^t_j \right]. \tag{6}$$

The right-most term in this expression ( $P^{t-1}_{j-0.5}K^t_j$ ) is equal to the net capital stock as calculated by the Dutch PIM. Therefore, expression (6) links the user cost of capital directly to the PIM. The characteristics of the Dutch PIM are described in detail by van den Bergen, de Haan, de Heij and Horsten (2005).

Two approximations are now being made. First, it is assumed that all asset price changes, other than those related to aging, are equal, irrespective the age j of the asset. Second, it is assumed that the price change over a half year is equal to the square root of the price change over a whole year; that is

$$\frac{P^{t-}_{j-0.5}}{P^t_{j-0.5}} \cong \frac{P^{t-}_0}{P^t_0} \cong \left( \frac{P^t_0}{P^{t-1}_0} \right)^{-1/2} \tag{6a}$$

$$\frac{P^{t+}_{j-0.5}}{P^t_{j-0.5}} \cong \frac{P^{t+}_0}{P^t_0} \cong \left( \frac{P^{t+1}_0}{P^t_0} \right)^{1/2} \ . \tag{6b}$$

In expressions (6a) and (6b), $P_0^t$ denotes the price of a new asset at time t. Applying these approximations together with the definition

$$\frac{P_{j+0.5}^t}{P_{j-0.5}^t} \equiv (1-\delta_{K,j}) \ , \tag{6c}$$

where $\delta_{K,j}$ denotes the depreciation rate of assets already in use (as distinct from the rate of newly invested assets)[5], the first term of expression (6) can be approximated by

$$\frac{u_j^t}{P_{j-0.5}^t} = (1+r^{t+,t-})\frac{P_{j-0.5}^{t-}}{P_{j-0.5}^t} - \frac{P_{j+0.5}^{t+}}{P_{j+0.5}^t}\frac{P_{j+0.5}^t}{P_{j-0.5}^t} \cong (1+r^{t+,t-})\left(\frac{P_0^t}{P_0^{t-1}}\right)^{-1/2} - \left(\frac{P_0^{t+1}}{P_0^t}\right)^{1/2}(1-\delta_{K,j}) \ . \tag{7}$$

The depreciation rate, $\delta_{K,j}$ , can be obtained directly from the PIM. The relation between this rate and consumption of fixed capital in the National Accounts is given by

$$\delta_{K,j} = \frac{CFC_{K,j}^t}{P_{j-0.5}^t K_j^t} \cong \left(\frac{P_0^t}{P_0^{t-1}}\right)^{-1} \frac{CFC_{K,j}^t}{P_{j-0.5}^{t-1} K_j^t} \ , \tag{8}$$

where $CFC_{K,j}^t$ denotes the consumption of assets already in use.

The user cost at prices of the previous year will be calculated as

$$U_{CP}^{t+1} \equiv \sum_{j=1}^{\infty} u_j^t K_j^{t+1} = \sum_{j=1}^{\infty} \frac{u_j^t}{P_{j-0.5}^t} P_{j-0.5}^t K_j^{t+1} \ . \tag{9}$$

The Laspeyres volume index for capital is calculated with help of expressions (6) to (9). However, in order to make these calculations, some assumptions with regard to the discount rate and price indices have to be made first.

### 3.1 Discount rate

With regard to the discount rate the first choice is between an exogenous and an endogenous rate. Employing an endogenous discount rate is in accordance with the standard neoclassical model, whereas employing an exogenous discount rate implies a deviation from the standard neoclassical model.

The standard neoclassical model is based on the two assumptions of constant returns to scale and perfect competition. Therefore no pure profits exist. All gross output of an enterprise is used to reward the inputs in the production process. The whole operating surplus / mixed income must therefore be allocated to user cost of capital and labour income of self employed. When labour income of self-employed is

[5] For vessels and barges the depreciation rate is time-dependent, since the depreciation profile of older craft differs from the profile of younger craft. From a conceptual point of view, such an asset type should be split into two (or more) types.

estimated exogenously, which is common practice, an endogenous discount rate is required to exhaust the operating surplus.

An exogenous discount rate however is determined independently of the operating surplus. For example the average interest on the capital market could be applied. Almost certainly an exogenous discount rate will lead to a discrepancy between the user cost of capital and the operating surplus. Pure profits will therefore be non-zero, causing a deviation from the standard neoclassical model.

Although the usefulness of the neoclassical model is generally recognized, its assumptions seem incompatible with economic reality, especially when there is rapid technological progress (and unbiased measurement of productivity change is more important then ever). To avoid making these assumptions, an exogenous discount rate will be employed. For the time being a real interest rate of four percent is employed for all industries.

### 3.2 Price indices

The price ratios in expressions (6), (7) and (8), as well as the conversion of real discount rates into nominal discount rates, require price indices. Following Schreyer, Diewert and Harrison (2005), the consumer price index (CPI) will be used to convert a real discount rate into a nominal one.

Since the capital stock is deflated with producer price indices (PPIs), a logical choice would be to use these PPIs also in expressions (6), (7) and (8). In some instances however, the combination of an exogenous discount rate with a PPI produces negative outcomes of expression (7). The interpretation of a negative user cost is not straightforward.

For the time being it is decided to use PPIs only for the calculation of the user cost of assets that exhibit an average price change which differs substantially from the CPI. For others assets, the user cost will be calculated with the CPI. In practice, this results in the use of PPIs only for computers and software. The substantial decline in computer prices over the last couple of years implies that holding losses are particularly relevant for computers.

As a consequence of applying the CPI in the user cost calculations the revaluation of assets in expression (7) differs from the revaluations that appear in expression (6) and (8). For capital stock measurement PPIs are used to revaluate all assets. In order to establish consistency between user cost and the capital stock valuation it may be desirable to use PPIs for the calculation of user cost of all assets in the future. However, this would require a solid interpretation of a negative user cost.

### 3.3 Summary of expressions

When the above described decisions with regard to the discount rate and price indices are applied, the user cost for all at the start of the year t existing assets, excluding taxes less subsidies, is calculated as

$$U^t \cong \sum_i \sum_{j=1}^{\infty} \frac{u_{i,j}^t}{P_{i,j-0.5}^t} \frac{PPI_i^t}{PPI_i^{t-1}} P_{i,j-0.5}^{t-1} K_{i,j}^t \tag{10}$$

$$\frac{u_{i,j}^t}{P_{i,j-0.5}^t} \cong (0.04 + \delta_{K,i,j}) \left( \frac{CPI^{t+1}}{CPI^t} \right)^{1/2} \tag{11}$$

$$\delta_{K,i,j} \cong \left( \frac{PPI_i^t}{PPI_i^{t-1}} \right)^{-1} \frac{CFC_{K,i,j}^t}{P_{i,j-0.5}^{t-1} K_{i,j}^t} \tag{12}$$

$$U_{CP}^{t+1} = \sum_i \sum_{j=1}^{\infty} \frac{u_{i,j}^t}{P_{i,j-0.5}^t} P_{i,j-0.5}^t K_{i,j}^{t+1} \quad . \tag{13}$$

For computers and software, expression (11) is replaced by

$$\frac{u_{i,j}^t}{P_{i,j-0.5}^t} \cong 1.04 \left( \frac{CPI^t}{CPI^{t-1}} \frac{CPI^{t+1}}{CPI^t} \right)^{1/2} \left( \frac{PPI_i^t}{PPI_i^{t-1}} \right)^{-1/2} - \left( \frac{PPI_i^{t+1}}{PPI_i^t} \right)^{1/2} (1 - \delta_{K,i,j}) \quad . \tag{14}$$

It is assumed that investments in second-hand assets from abroad and investments in new assets (domestically produced as well as imported) are made halfway a year. Thus, for these assets a different user cost expression must be used. The details of the derivation are provided by Balk and van den Bergen (2006). The user cost for all invested assets is calculated as[6] [7]

$$V^t = \sum_i \sum_{j=0}^{\infty} \frac{v_{i,j}^t}{P_{i,j}^t} P_{i,j}^t I_{i,j}^t \tag{15}$$

$$\frac{v_{i,j}^t}{P_{i,j}^t} \cong (\sqrt{1.04} - 1 + \delta_{I,i,j} / 2) \left( \frac{CPI^{t+1}}{CPI^t} \right)^{1/2} \tag{16}$$

$$\delta_{I,i,j} = 2 \frac{CFC_{I,i,j}^t}{P_{i,j}^t I_{i,j}^t} \tag{17}$$

$$V_{CP}^{t+1} \cong \sum_i \sum_{j=0}^{\infty} \frac{v_{i,j}^t}{P_{i,j}^t} \frac{PPI_i^t}{PPI_i^{t+1}} P_{i,j}^{t+1} I_{i,j}^{t+1} \quad . \tag{18}$$

For computers and software, expression (16) is replaced by

$$\frac{v_{i,j}^t}{P_{i,j}^t} \cong \sqrt{1.04} \left( \frac{CPI^{t+1}}{CPI^t} \right)^{1/2} - \left( \frac{PPI_i^{t+1}}{PPI_i^t} \right)^{1/2} (1 - \delta_{I,i,j} / 2) \quad . \tag{19}$$

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[6] In order to avoid confusion, user cost for invested assets are represented with the letter v instead of the letter u.

[7] Because figures are rounded off in the calculations of the net capital stock and consumption of fixed capital, $\delta_{K,i,j}$ and $\delta_{I,i,j}$ slightly differ. However, these differences are negligible.

Total user cost[8], including taxes less subsidies, is now calculated as

$$U^{*t} = U^t + V^t + T^t \tag{20}$$

$$U_{CP}^{*t+1} = U_{CP}^{t+1} + V_{CP}^{t+1} + T_{CP}^{t+1} \ , \tag{21}$$

where the subscript CP denotes that the variable is valued at the prices of the previous year. The tax component will be discussed in chapter 5.

## 4. Labour inputs

Production also requires labour. For any industry[9], labour cost is calculated as the sum of three components,

$$W^{*t} = W_E^t + W_S^t + T_L^t \equiv W^t + T_L^t \ , \tag{22}$$

where $W^{*t}$ denotes total labour cost;

$W_E^t$ denotes compensation of employees;

$W_S^t$ denotes labour income of self-employed;

$T_L^t$ denotes the sum of taxes less subsidies on labour;

$W^t$ denotes total labour cost excluding taxes less subsidies.

Thus, per industry two types of labour are being distinguished. For each type, the unit of measurement is an hour worked. The tax component will be discussed in chapter 5.

### 4.1 Compensation of employees

The compensation of employees in current prices is directly available from the Dutch National Accounts. However, the same compensation in previous year's prices cannot be used because the deflation is not executed with volume indexes of hours worked. Following international recommendations (OECD 2001), we calculate

$$W_{E,CP}^{t+1} \equiv w_E^t L_E^{t+1} = w_E^t L_E^t \frac{L_E^{t+1}}{L_E^t} \equiv W_E^t \frac{L_E^{t+1}}{L_E^t} \ , \tag{23}$$

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[8] Livestock for breeding, dairy, draught, etc. (AN.11141), non-produced assets (AN.2) and inventories (AN.12) are not included in the capital services.

[9] For the calculation of labour input of both employees and self-employed, 49 different industries are distinguished.

where $W^t_{E,CP}$ denotes the compensation of employees at prices of the previous year, $w^t_E$ denotes the compensation per hour and $L^t_E$ denotes the hours worked.

In order to retain a consistent set of supply and use tables, the National Accounts (in constant prices) should be balanced with this newly calculated compensation of employees at prices of the previous year. This can easily be accomplished by adjusting the operating surplus. In this way consistency is retained without changing any other input or output quantity.

### 4.2 Labour income of self-employed

Unlike compensation of employees, no explicit estimate of labour income of self-employed is provided in the Dutch National Accounts. Labour income of self-employed is, together with the user cost of capital of the sector households (S.14) and the pure profits of S.14, part of mixed income.

When gross fixed capital formation, consumption of fixed capital and the capital stock are broken down into institutional sectors, it is possible to directly calculate the user cost of capital of S.14. However, it is not possible to measure directly either pure profits of S.14 or labour income of self-employed. Therefore, in order to break down mixed income, some assumption with regard to pure profits of S.14 or labour income of self-employed must be made. Two feasible assumptions are that self-employed have the same income per hour or per year as employees, or that there are no pure profits for S.14. The last assumption allows labour income of self-employed to be calculated endogenously.

For calculating labour-income of self-employed endogenously, it is important that the estimates of mixed income, gross fixed capital formation, consumption of fixed capital and the capital stock of S.14 are reliable. Although estimates of these variables are available at Statistics Netherlands, they currently lack the quality required for the calculation of labour income of self-employed. Thus we turn to the possibilities for exogenous estimation.

Although firm evidence is lacking, most data suggest that self-employed work more hours than employees without earning substantially more money. It is therefore assumed that self-employed have the same labour income per year as employees.[10]

There are a few exceptions to this assumption. In some medical sectors, for instance in the case of dentists and general practitioners, the self-employed generally have a university degree, whereas the employees mostly have a lower educational level. Since educational level is generally positively correlated with earnings, it is expected that in these sectors self-employed have a higher income than employees. Therefore, for the year 2003, in these sectors labour income of self-employed is set

[10] The method for calculating labour income of self-employed may change when more research in this area has been conducted.

at a so-called standard income[11] of these professions. It is further assumed that the development of labour income of the self-employed equals the development of wages of employees in these sectors.

For some professions, e.g. lawyers, accountants and architects, which are included in the financial and business activities branch, it is also expected that self-employed have a higher income than employees. However, there is no data available with regard to some standard income of these professions. It is therefore assumed that these self-employed have the same income per year as employees.

For 2001-2003, compensation of employees and numbers of full-time equivalent jobs (fte) of employees and self-employed are available for 260 industries. For earlier years, however, numbers of fte's are only available at a higher aggregation level. Since the proportion of self-employed (in fte's) differs per industry, imputing the same yearly income for self-employed as employees at a higher aggregation level leads to different results than when imputation is done at a lower aggregation level. For this reason, the average ratio α between the labour income of self-employed per fte and the compensation of employees per fte is calculated for the period 2001-2003 and it is assumed that this ratio is constant over time. For the years before 2001, the labour income of self-employed can then be calculated as[12]

$$W_S^t = \alpha W_E^t \frac{LY_S^t}{LY_E^t} = \alpha \frac{W_E^t}{LY_E^t} LY_S^t \ , \tag{24}$$

where $LY^t$ denotes fte's. The labour income of self-employed at prices of the previous year is then calculated by multiplying the hours worked in the current year with the labour income of employees per hour worked in the previous year; that is

$$W_{S,CP}^{t+1} \equiv w_S^t L_S^{t+1} = w_S^t L_S^t \frac{L_S^{t+1}}{L_S^t} \equiv W_S^t \frac{L_S^{t+1}}{L_S^t} \ . \tag{25}$$

### 4.3 Summary of expressions

Per industry, total labour cost is, at current prices, calculated as

$$W^{*t} = W_E^t + W_S^t + T_L^t \ , \tag{26}$$

and, at previous year's prices, as

$$W_{CP}^{*t+1} = W_{E,CP}^{t+1} + W_{S,CP}^{t+1} + T_{L,CP}^{t+1} \ . \tag{27}$$

Again, the tax component will be discussed in the next chapter.

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[11] This is a rough estimate used to inform medical students about their expected future salaries.

[12] For the year 2004 the same method as for the years before 2001 is currently used. As soon as the final National Accounts figures for the year 2004 are available, the calculation of labour income of self-employed will also be based on 260 different industries for this year.

## 5. Other inputs and output

Gross output, value added and intermediate consumption (with its E, M, and S components) are estimated in the context of the National Accounts. Production surveys, foreign trade statistics and surveys on consumption and investments are the most important data-sources. The Netherlands' National Accounts database consists of data for very detailed product groups, which are further subdivided to origin and destination, and which have different valuation layers. From this database, supply and use tables and input-output tables can be derived. Approximately 120 industries and 275 product groups are being distinguished. This level of detail is sufficient for measuring productivity change as described in the foregoing. With respect to constant price estimation, a combination of (chained) Paasche price index numbers and Laspeyres volume index numbers is used. The price statistics for production, international trade and private consumption of households are the main sources for the deflators.

Although both value added and gross output (in current prices and prices of the previous year) can be directly derived from the National Accounts, gross output must be consolidated before it can be used for the gross output productivity measures.

The cost components of intermediate consumption can also be derived from the National Accounts. The intermediate consumption that is used for our productivity measures is calculated as the intermediate consumption at basic prices plus the sum of taxes less subsidies on products. In contrast with the National Accounts, for productivity measurement trade and transport margins are not attributed to the products on which they are imposed, but they are recorded as a service. This way, energy, materials and services are separated properly. In addition, intermediate consumption must also be consolidated.

Three problems remain to be solved: 1) the consolidation of output and intermediate consumption, 2) the allocation of taxes less subsidies on production to the various inputs, and 3) the subdivision of intermediate consumption into energy, goods and services components. The first two problems will be addressed in the next two sections; the third problem is currently under research.

### 5.1 Consolidation

The most detailed National Accounts supply-use database of the Netherlands contains the following three dimensions: industry of supply × industry of demand × product group. Thus, generally, the amounts of intra-industry deliveries can be determined directly for each product group. Trade and transport margins constitute the only exception to this rule. This is caused by the fact that these margins are registered as a so-called valuation layer. They are recorded as part of the purchase value of product groups on which these margins are imposed. As a consequence, in the National Accounts' database, the producer of the product on which the margins are imposed instead of the producer of the margins is registered as the origin of the

margins. This implies that the intra-industry deliveries of margins cannot be identified since the original producers of these margins remain unidentified.

As a result an assumption must be made about the producer's of trade and transport margins. For the time being, it is assumed that the intra-industry deliveries of margins are as large as possible.[13] This means that when an industry consumes more margins than it produces, all margins produced in this industry are considered intra-industry deliveries. When an industry produces more margins than it consumes, all margins consumed are supposed to be intra-industry deliveries.

These intra-industry deliveries are subsequently excluded from gross output and intermediate consumption to obtain sectoral output and intermediate input.

### 5.2 Taxes less subsidies

Productivity measurement requires output to be valued at basic prices; that is, the prices actually obtained by producers. At the same time, input must be valued at purchasers' prices.

Taxes less subsidies on *products* are already included in the costs of the intermediate consumption components. Taxes less subsidies on *production* (according to the National Accounts classification), at current prices as well as at prices of the previous year, can be obtained directly from the National Accounts. As far as sensible, the components of this expenditure category should be attributed to the various inputs.

Some of these taxes less subsidies can directly be attributed to a specific input. Wage subsidies can be attributed to labour, and road taxes as well as property taxes to capital. Other taxes less subsidies, like sewage charges and PBO-levies, cannot be attributed to some single category of inputs. Such taxes less subsidies on production could somehow be distributed over all the input categories. A practical difficulty, however, is the fact that it is not always possible to separate the taxes less subsidies that can be attributed to capital from the remaining taxes less subsidies. A pragmatic solution is to attribute all taxes less subsidies on production to capital, with the exception of wage subsidies, which are of course attributed to labour.[14]

Finally, tax deductions should be taken into account in the user cost of capital. In the Netherlands, some costs of capital, e.g. interest paid on mortgages, can be deducted from pre-tax income. In effect therefore, the use of such capital goods is subsidized. For the time being, however, such tax deductions will not be taken into account.

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[13] The method used to consolidate margins may change as a result of more research.

[14] Statistics Canada (2001) attributes all taxes less subsidies on production to the factor capital.

### 5.3 Summary of expressions

Per industry, the Laspeyres volume index of the combined KLEMS inputs is calculated as

$$Q_{L,KLEMS}^{t+1} = \frac{U_{CP}^{*t+1} + W_{CP}^{*t+1} + EMS_{CP}^{*t+1}}{U^{*t} + W^{*t} + EMS^{*t}} \quad , \tag{28}$$

where: $U^{*t}$ denotes the user cost of capital in year t, as given by expression (20);

$U_{CP}^{*t+1}$ denotes the user cost of capital in year t+1 valued at prices of year t, as given by expression (21);

$W^{*t}$ denotes the labour cost in year t, as given by expression (26);

$W_{CP}^{*t+1}$ denotes the labour cost in year t+1 valued at prices of year t, as given by expression (27);

$EMS^{*t}$ denotes the (consolidated) value of energy, materials and services in year t;

$EMS_{CP}^{*t+1}$ denotes the (consolidated) value of energy, materials and services in year t+1 valued at prices of year t.

The Laspeyres volume index of the combined capital and labour inputs is calculated as

$$Q_{L,KL}^{t+1} = \frac{U_{CP}^{*t+1} + W_{CP}^{*t+1}}{U^{*t} + W^{*t}} \quad . \tag{29}$$

## 6. Some Sensitivity analyses

The method described in the previous chapters will be called the baseline method. According to this method gross-output based TFP change and value-added based TFP change are computed for the period 1995-2004. Next, the calculations are repeated using alternative assumptions with regard to the volume index formula, the user cost of capital, the labour income of self-employed, and the consolidation of trade and transport margins. The productivity changes following from these alternative methods are compared with the results of the baseline method.

Calculations have been performed at three different levels of aggregation: 42 industries, 11 industries, and the business sector. The business sector is here defined as the entire economy less general government, defence, public education, and real estate services.

For the sake of readability, the results for the aggregation level of 42 industries are not presented in this paper. Moreover, general government, defence, public

education, and real estate services are excluded from the tables, as no independent output volume measures are available for (most of) these industries.[15]

In tables 1 and 2, the gross-output based and value-added based TFP change as calculated with the baseline method are presented. With this method, the average (1995-2004) gross-output based TFP change for the business sector is 0.75 percent, and the average value-added based TFP change is 1.13 percent.

### 6.1 Paasche volume index

In the baseline method, Laspeyres volume indices were used, together with Paasche price indices. In order to judge the sensitivity of the outcomes due to the index formulas used, an attempt should be made to calculate with Paasche volume indices and Laspeyres price indices. Generically, the Paasche volume index is given by

$$Q_P^t \equiv \frac{\sum_i p_i^t q_i^t}{\sum_i p_i^t q_i^{t-1}}, \tag{30}$$

and it is clear, by comparison to expression (1), that such an index requires the same data as the Laspeyres volume index. Thus, applying the Paasche-Laspeyres pair instead of the Laspeyres-Paasche pair to the National Accounts database would provide an alternative set of productivity measures.

Research on this issue is still underway. An important, practical, issue is the determination of the elementary aggregate level as point of departure for the calculations.

### 6.2 A different method for the consolidation of margins

In the baseline method, intra-industry deliveries of margins are assumed to be as large as possible. The gross-output based TFP change is recalculated under the reverse assumption that intra-industry deliveries of margins are as small as possible[16]. In this case intra-industry deliveries of margins would only exist when an industry consumes more margins than all other industries together produce. In practice, this means that for all industries the intra-industry deliveries are assumed to be zero. Only for the entire business sector, margins are considered as intra-industry deliveries.

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[15] In some other industries, like research and development services, and sewage and refuse disposal, part of the output is produced by non-market producers. For these non-market producers, the estimation of output is based on input measures. Theoretically, such data should also be excluded. Currently however, no data sources are available on the basis of which these non-market producers could be excluded. Therefore, they remain included in the results presented here.

[16] With the intra-industry deliveries minimized and maximized, the outer boundaries of the TFP change are estimated.

The resulting gross-output based TFP changes are presented in table 3. Since consolidation has no effect on value added, value-added based TFP change is not altered by a different treatment of intra-industry deliveries of margins.

As shown in table 3, the effect of a different treatment of intra-industry deliveries of margins on TFP change is almost negligible. For manufacturing and for trade, hotels, restaurants and repair, the average productivity change decreases with a few hundreds of a percent point. The largest effect in a single year is for mining and quarrying in 1997. For this year, TFP change is 0.2 percent point smaller than when the baseline method is used.

It should be noted that at the level of the business sector a different treatment of intra-industry deliveries of margins has no effect on the results. This is caused by the fact that all margins are produced by the business sector, due to which the maximum intra-industry deliveries are equal to the minimum intra-industry deliveries.

### 6.3 Other labour income for self-employed

In the baseline method, it is assumed that the annual labour income of self-employed is equal to the annual labour income of employees. In the literature, for example the OECD manual Measuring Productivity (2001), it is often advised to assume that self-employed have the same *hourly* labour income as employees. Therefore, TFP changes are recalculated under the last assumption.

To calculate the labour income of self-employed under this assumption an approach similar to the baseline method is employed. Like the full-time equivalent jobs, for the years 2001-2003 hours worked are available for 260 different industries, whereas for other years hours worked are only available at a higher aggregation level. At this higher aggregation level, the average ratio β between the labour income of self-employed per hour and the compensation of employees per hour is calculated for the period 2001-2003. It is next assumed that this ratio is constant over time. For the years before 2001 the labour income of self-employed is then calculated as[12]

$$W_S^t = W_E^t \beta \frac{L_S^t}{L_E^t} = \beta \frac{W_E^t}{L_E^t} L_S^t \ . \qquad (32)$$

The labour income of self-employed valued at prices of the previous year is, in line with the baseline method, calculated according to expression (25).

In tables 4 and 5, the resulting gross-output based TFP changes and value-added based TFP changes are presented. In all industries except construction, the average TFP change is higher than the results of the baseline method. Agriculture, forestry and fishing and trade, hotels, restaurants and repair are the only industries showing a difference of more than 0.1 of a percent point in average gross-output based TFP change. At the level of the business sector, average gross-output based TFP change increases with 0.07 percent points, whereas the average value-added based TFP change increases with 0.09 percent points. In contrast with these average increases, the TFP change (both gross-output based and value-added based) shows a small decrease in 1996 and 2004 as compared to the results of the baseline method.

Although the difference in the average TFP change is higher in trade, hotels, restaurants and repair, the largest (absolute) differences with the baseline method also occur in agriculture, forestry and fishing. Not surprisingly this is the industry with the highest percentage of self-employed. In this industry, in 2000, gross-output based TFP change is 0.8 percent points lower, whereas in 1998 and 2001 the gross-output based TFP change is about the same amount higher than the baseline method. For these two years, the value-added based TFP change in this industry is even more than one percent point higher than the baseline method.

### 6.4 Other treatment of holding gains and losses

In the baseline method, for the calculation of the user cost of capital, the real asset inflation rate is assumed to be zero for all assets except computers and software. Therefore, holding gains and losses are, in the baseline method, only included in the user cost of capital for computers and software. We have made two alternative calculations of TFP change. First, assuming no holding gains and losses for all assets and, second, including holding gains and losses for all assets.[17]

In tables 6 and 7, results are presented for the assumption of no holding gains and losses for all assets. In tables 8 and 9, results are presented when holding gains and losses are included for all assets.

When holding gains and losses are excluded, the TFP change increases slightly in comparison to the results of the baseline method. There are no decreases. For the business sector, the average gross-output based TFP change increases with 0.11 percent points and the average value-added based TFP change increases with 0.17 percent points.

The difference with the baseline method is at its largest in the period 1997-1999. Since then, the difference is steadily declining. In 2004, the difference in gross-output based TFP is reduced to about 0.03 percent points. The only industry where the difference in the average gross-output based TFP change is larger than 0.1 percent point is financial and business activities, but even in this industry the difference in 2004 is only 0.04 percent points. The difference in the average value-added based TFP gives a somewhat different picture. Here the difference is larger than 0.1 percent points for seven out of nine industries.

When holding gains are included for all assets, the differences in average TFP change with the baseline method are almost negligible. The largest differences occur in mining and quarrying, with 0.3 percent points in gross-output based TFP change in 2001. For the other industries, the differences in gross-output based TFP change with the baseline method never surpass 0.1 percent point. For trade, hotels, restaurants and repair, differences never even surpass 0.01 percent points.

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[17] Except transfer costs. Since transfer costs cannot be sold, it is not possible to cash in on their holding gains and losses. Therefore, in our opinion holding gains and losses on transfer costs should never be included in the user cost of capital. Transfer costs are sunk costs.

The differences with the baseline method in value-added based TFP are slightly higher, but even here these differences remain very small. Only for agriculture, forestry and fishing and mining and quarrying, the differences with the baseline method surpass 0.1 percent points for some years.

### 6.5 Other exogenous discount rates

In the baseline method the real discount rate is set at 4 percent. Calculations of TFP changes are repeated with discount rates of 3 and 5 percent. The results for 3 percent are presented in tables 10 and 11, and for 5 percent in tables 12 and 13

The differences in TFP change as compared to the baseline method are very small. Only for mining and quarrying, and for electricity, gas and water supply, are differences in either gross-output based or value-added based TFP change for some years greater than 0.1 percent point. For the business sector, the differences are negligible.

Around a discount rate of 4 percent, the TFP change appears to be more or less linear with the discount rate. The differences in TFP change between a discount rate of 4 and 3 percent are therefore more or less the opposite of the differences between a discount rate of 4 and 5 percent.

For some industries, like electricity, gas and water supply and transport, storage and communication, the differences with the baseline method have different signs for gross-output and value-added based TFP change. While in the industry electricity, gas and water supply the difference in average gross-output based TFP change between a discount rate of 3 and 4 percent is -0.04 percent point, the difference is +0.02 percent point for average value-added based TFP change. If the ratio between value-added based TFP change and gross-output based TFP change were equal to the Domar factor, this would not be possible. In chapter 7 the Domar factors will be discussed in more detail.

### 6.6 Endogenous discount rates

TFP changes are also calculated by using endogenous discount rates. An endogenous discount rate for each industry and year is determined under the condition that

$$U^{*t} + W^{*t} = VA^t, \tag{33}$$

where $VA^t$ is value added of year t. To calculate these discount rates, in expressions (14), (16) and (19), the value 1.04 must be replaced by $1+r^t$, and in expression (11), the value 0.04 must be replaced by $r^t$. Next, $r^t$ is solved from expression (10)-(20) while expression (33) holds.

In the calculation of the user cost of capital with endogenous discount rates, holding gains are included for all assets (except transfer costs). Two different scenarios have been studied. In the first scenario, it is assumed that self-employed receive the same

annual labour income as employees; whereas in the second scenario it is assumed that self-employed receive the same hourly labour income as employees.

Results for both scenarios are shown in tables 14 and 15. Some of the discount rates, especially in table 14, seem extraordinary high. For mining and quarrying, wholesale trade and to a lesser extent for trade and repair of motor vehicles/cycles, a plausible explanation for this is the incompleteness of the capital inputs. Natural resources and inventories are excluded from the capital inputs, and since they are very important in these industries, this exclusion leads to excessively high discount rates. For some other industries, like construction and computer and related activities, at the end of the nineties, self-employed may have had a higher hourly labour income than employees. The excessive discount rates are in these cases probably caused by an underestimation of labour income of self-employed.

The calculations resulted in some instances in negative endogenous discount rates. Furthermore, negative user cost of capital values occurred for some combinations of industry and asset type. In cases where the operating surplus of an industry is negative, the total user cost of capital must be negative as well. However, for the purpose of getting some sensitivity results, TFP change is calculated in all these instances, disregarding theoretical problems with negative discount rates or negative user cost of capital values.

In tables 16 and 17, TFP change is presented under the assumption that self-employed receive the same annual income as employees. In tables 18 and 19, TFP change is presented under the assumption that self-employed receive the same hourly income as employees.

For mining and quarrying the differences in average TFP change, as compared with the results of the baseline method, are very large. As already mentioned when discussing the high discount rates in this industry, this is probably due to the exclusion of natural resources as capital input. Endogenous discount rates are only meaningful when all inputs in the production process are accounted for. For mining and quarrying, natural resource extraction constitutes quite likely the most important production factor. By using endogenous discount rates, these production costs are completely assigned to the other capital services.

For manufacturing, electricity, gas and water supply and care and other service activities, the differences with the baseline method in gross-output based TFP change are generally less than 0.1 percent point. The same holds for value-added based TFP change, although for manufacturing, the differences in value-added based TFP are larger. In the other industries, the differences with the baseline method in TFP change are much higher (up to 0.5 percent point for most industries but for mining and quarrying and agriculture, forestry and fishing even up to 2.8 percent point).

Apart from mining and quarrying, the most extreme differences with the baseline method occur in agriculture, forestry and fishing. When endogenous discount rates are used and self-employed are given the same hourly labour income as employees, the differences with the baseline method in value-added TFP change are for some

years up to 3 percent points. This volatility is probably caused by the large share of self-employed in this industry, inducing a large uncertainty with respect to the compensation of self-employed and therefore also a large uncertainty in the endogenously determined user cost of capital. The combination of the assumption that the hourly labour income for self-employed is the same as that for employees with the assumption of endogenous discount rates causes the compensation of self-employed to be much higher and the user cost of capital to be much smaller than in the baseline method.

### 6.7 Sensitivity analyses: main conclusions

From the sensitivity analyses presented in the preceding paragraphs, it follows that TFP change is fairly insensitive to the method used for the consolidation of trade and transport margins. The inclusion of holding gains in the user cost for all assets also has a limited impact on TFP change. The same is true for variations in the real discount rate.

Excluding holding gains for computers and software, however, leads to an increase in TFP change for all industries, although the differences with the baseline method are decreasing over time. In addition, using for self-employed the same hourly labour income as for employees, instead of the same yearly income, causes differences that exceed 0.5 percent points for some years for agriculture, forestry and fishing, construction and trade, hotels, restaurants and repair.

The largest differences occur when endogenous instead of exogenous rates of return are employed. Although for some industries the effects are rather limited, results for agriculture, forestry and fishing and mining and quarrying show extreme differences. For mining and quarrying, this can be explained by the incompleteness of the capital inputs in the accounting exercise. For agriculture, forestry and fishing, it seems inherent to the industry.

## 7. Domar factors

As mentioned in section 2.2, Balk (2003b) showed that under the assumption of no profit, for a fairly large class of index formulas, the ratio of value-added to gross-output based TFP change (each expressed as the logarithm of an index number) is proportional to the ratio of gross output to value added, which is the so-called Domar factor.

Thus, the Domar factor can be approximated by dividing the value-added based TFP change by the gross-output based TFP change as in

$$D_1^t = \frac{\ln(\Pi_{VA,KL}^t)}{\ln(\Pi_{GO,KLEMS}^t)}, \tag{34}$$

where $\Pi^t_{VA,KL}$ denotes the value-added based TFP index and $\Pi^t_{O,KLEMS}$ the gross-output based TFP index. The original computation method for the Domar factor is by dividing (sectoral) gross output by value added; that is, for instance,

$$D_2^t = \frac{GO^{t-1}}{VA^{t-1}}, \tag{35}$$

where $GO^{t-1}$ denotes the value of (sectoral) gross output in year t - 1 and $VA^{t-1}$ value added in year t – 1 (both in current prices).

Since in the baseline method it is not assumed that total cost is equal to gross output, these two approaches to the Domar factor do not necessary deliver the same results. In table 20, Domar factors are presented as calculated according to expression (34), and in table 21 according to expression (35). Their ratios are presented in table 22.

Though many of the ratios are near unity, sometimes the two approaches differ quite a lot. The largest differences appear in electricity, gas and water supply, with a maximum ratio of 18 for one year. This is clearly an outlier. At a lower aggregation level, some negative values appear. In these cases gross output based TFP change and value added TFP change have opposite signs. In the business sector as a whole, the smallest ratio is 0.68 and the largest is 1.15. The largest differences appear when TFP change is in the neighbourhood of zero. In these cases, small changes in TFP may lead to large changes in the ratio between the two estimates of the Domar factor. Extreme values of this ratio do therefore not necessarily correspond with large differences between the two measures of TFP change.

To test this, value-added based TFP change is calculated from output-based TFP change and the Domar factor; that is, by

$$\Pi^{*t}_{VA,KL} = \exp(\ln(\Pi^t_{GO,KLEMS})D_2^t). \tag{36}$$

The results of expression (36) are presented in table 23. For mining and quarrying, this leads to differences of up to 3 percent points with value-added based TFP change as calculated with the baseline method (table 2). This may be due to the exclusion of natural resources as input factors, which causes gross output to be much larger than cost. For the other industries, as well as for the business sector as a whole, the differences with value-added based TFP change as calculated with the baseline method are much smaller. The largest difference, 0.7 percent point, is found in agriculture, forestry and fishing in 2000. For care and other service activities, the differences are the smallest. The largest difference found in this industry is 0.02 percent point in 2000.

## 8. Conclusions and future work

This paper presents the preliminary results of a system of productivity statistics that is currently under construction at Statistics Netherlands. The paper shows that the

National Accounts provide a solid statistical basis for productivity measurement. However, a number of modifications in National Accounts statistics are advised:

- Additional entries in the income generation sub-matrix of the use tables are needed to account for capital services in current and constant prices.
- Similar entries in the use table are needed to account for the labour income of self-employed.
- Additional entries are needed for the recording of pure profits, because an exogenous rate of return is being used. One could argue that these pure profits constitute a new balancing item in the income generation account.
- Taxes less subsidies on production should not automatically be an independent entry in the income generation account. Instead they should as far as possible be allocated to the various inputs.
- A more flexible recording of trade and transport margins in the underlying database would lead to assumption-free consolidation procedures.

Such modifications are not impossible, and the resulting system of growth accounts can then fully be brought in line with existing methods of economic growth measurement.

Next year, the National Accounts will be extended in the following three directions. These extensions are expected to further support the compilation of productivity statistics:

- It is scheduled to include in the calculation of hours worked and the compensation of employees by industry branch a breakdown by educational attainment. This means that in the near future quality changes in labour will better be covered in the productivity statistics of the Netherlands;
- The annual production of a so-called knowledge module[18] will provide statistics on knowledge related inputs into production such as the capital services of R&D and ICT. The representation of R&D capital services in the National Accounts constitutes yet another deviation from mainstream national accounting;
- It is scheduled to construct complete balance sheets for non-financial assets. For productivity measurement this implies that the coverage of assets will be extended to inventories and non-produced assets such as land and mineral reserves.

[18] See for details de Haan and Horsten 2004, a revised version of which will appear as de Haan and Horsten 2007.

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# Appendix

Table 1. Gross-output based TFP change using the baseline method[1], in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.6 | 1.2 | -4.3 | -1.5 | -0.8 | 4.0 | 3.1 | 0.25 |
| Mining and quarrying | 1.6 | -6.8 | -6.6 | 0.7 | -5.3 | 3.5 | -1.2 | -1.1 | 5.1 | -1.21 |
| Manufacturing | 0.5 | 0.0 | 0.7 | 0.9 | 2.1 | -0.1 | 0.6 | 0.2 | 1.3 | 0.70 |
| Electricity, gas and water supply | 1.8 | -3.0 | -0.4 | -0.5 | 1.8 | 1.9 | 4.0 | 0.0 | -0.4 | 0.55 |
| Construction | -1.8 | -1.0 | 0.5 | 0.8 | 0.0 | -0.4 | -1.0 | -0.8 | 1.0 | -0.29 |
| Trade, hotels, restaurants and repair | 1.0 | 4.0 | 2.0 | 1.8 | 1.2 | -1.1 | -0.4 | 2.3 | 2.7 | 1.47 |
| Transport, storage and communication | 0.6 | 3.0 | 3.2 | 0.9 | 2.3 | 0.7 | 2.0 | 1.9 | 2.4 | 1.89 |
| Financial and business activities [2] | 0.5 | 0.2 | -0.8 | -0.6 | -2.0 | 0.3 | -1.7 | 0.8 | 2.4 | -0.11 |
| Care and other service activities | -0.2 | -1.0 | -0.5 | 0.0 | 0.7 | -0.3 | 0.5 | -1.1 | -0.3 | -0.24 |
| business sector | 0.6 | 0.8 | 0.7 | 0.9 | 0.7 | -0.1 | -0.1 | 0.8 | 2.3 | 0.75 |

[1] as described in chapters 2, 3, 4 and 5

[2] excluding real estate services

Table 2. Value-added based TFP change using the baseline method [1], in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.4 | 5.1 | -0.7 | 2.3 | -7.7 | -2.9 | -1.7 | 8.1 | 6.0 | 0.56 |
| Mining and quarrying | 5.0 | -8.5 | -9.0 | 1.1 | -5.2 | 6.7 | -1.9 | -3.2 | 9.0 | -0.86 |
| Manufacturing | 1.7 | 0.6 | 2.4 | 2.7 | 6.2 | -0.4 | 1.6 | 0.7 | 4.1 | 2.16 |
| Electricity, gas and water supply | 4.7 | -7.8 | -1.2 | -1.5 | 4.7 | 5.4 | 12.2 | -0.2 | -0.8 | 1.58 |
| Construction | -4.0 | -2.2 | 1.3 | 2.0 | 0.2 | -1.0 | -2.4 | -1.5 | 2.6 | -0.59 |
| Trade, hotels, restaurants and repair | 1.9 | 7.3 | 3.7 | 3.2 | 2.4 | -1.8 | -0.6 | 3.4 | 4.7 | 2.67 |
| Transport, storage and communication | 1.1 | 5.7 | 6.4 | 1.9 | 4.6 | 1.4 | 4.0 | 3.6 | 4.6 | 3.67 |
| Financial and business activities [2] | 0.6 | 0.4 | -1.0 | -0.8 | -2.6 | 0.5 | -2.6 | 1.0 | 3.4 | -0.13 |
| Care and other service activities | -0.2 | -1.5 | -0.8 | 0.0 | 1.0 | -0.5 | 0.8 | -1.6 | -0.4 | -0.35 |
| business sector | 0.8 | 1.4 | 1.2 | 1.3 | 1.2 | -0.2 | 0.0 | 1.1 | 3.3 | 1.13 |

[1] as described in chapters 2, 3, 4 and 5

[2] excluding real estate services

Table 3. Gross-output based TFP change, minimizing the intra-industy deliveries of margins, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.5 | 1.2 | -4.2 | -1.4 | -0.8 | 3.9 | 3.0 | 0.25 |
| Mining and quarrying | 1.7 | -7.0 | -6.5 | 0.7 | -5.2 | 3.5 | -1.2 | -1.2 | 5.1 | -1.20 |
| Manufacturing | 0.5 | 0.1 | 0.7 | 0.9 | 2.0 | -0.1 | 0.6 | 0.2 | 1.3 | 0.67 |
| Electricity, gas and water supply | 1.8 | -3.0 | -0.4 | -0.5 | 1.8 | 1.9 | 4.0 | 0.0 | -0.4 | 0.55 |
| Construction | -1.8 | -0.9 | 0.5 | 0.8 | 0.0 | -0.4 | -1.0 | -0.7 | 1.0 | -0.29 |
| Trade, hotels, restaurants and repair | 0.9 | 4.0 | 1.9 | 1.7 | 1.2 | -1.1 | -0.4 | 2.3 | 2.7 | 1.45 |
| Transport, storage and communication | 0.6 | 3.0 | 3.2 | 0.9 | 2.3 | 0.7 | 2.0 | 1.9 | 2.4 | 1.89 |
| Financial and business activities [1] | 0.4 | 0.2 | -0.8 | -0.6 | -2.0 | 0.3 | -1.7 | 0.8 | 2.4 | -0.11 |
| Care and other service activities | -0.1 | -1.0 | -0.5 | 0.0 | 0.7 | -0.3 | 0.5 | -1.1 | -0.3 | -0.24 |
| business sector | 0.6 | 0.8 | 0.7 | 0.9 | 0.7 | -0.1 | -0.1 | 0.8 | 2.3 | 0.75 |

[1] excluding real estate services

Table 4. Gross-output based TFP change, giving self-employed the same hourly labour compensation as employees, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.4 | 2.7 | 0.4 | 1.0 | -5.1 | -0.8 | -0.6 | 4.2 | 3.4 | 0.40 |
| Mining and quarrying | 1.6 | -6.8 | -6.6 | 0.7 | -5.3 | 3.5 | -1.2 | -1.1 | 5.1 | -1.20 |
| Manufacturing | 0.5 | 0.0 | 0.7 | 1.0 | 2.1 | -0.1 | 0.6 | 0.2 | 1.3 | 0.71 |
| Electricity, gas and water supply | 1.8 | -3.0 | -0.4 | -0.5 | 1.8 | 1.9 | 4.0 | 0.0 | -0.4 | 0.55 |
| Construction | -2.0 | -1.1 | 0.5 | 0.7 | 0.1 | -0.5 | -1.1 | -0.8 | 0.8 | -0.38 |
| Trade, hotels, restaurants and repair | 1.1 | 4.6 | 2.2 | 2.1 | 1.5 | -1.0 | -0.3 | 2.4 | 2.6 | 1.66 |
| Transport, storage and communication | 0.6 | 3.1 | 3.3 | 1.0 | 2.4 | 0.8 | 2.1 | 1.9 | 2.3 | 1.95 |
| Financial and business activities [1] | 0.4 | 0.3 | -0.6 | -0.4 | -1.8 | 0.4 | -1.8 | 0.7 | 2.3 | -0.04 |
| Care and other service activities | -0.1 | -1.0 | -0.5 | 0.1 | 0.7 | -0.3 | 0.6 | -1.1 | -0.2 | -0.21 |
| business sector | 0.5 | 1.0 | 0.9 | 1.0 | 0.8 | 0.0 | 0.0 | 0.9 | 2.2 | 0.82 |

[1] excluding real estate services

Table 5. Value-added based TFP change, giving self-employed the same hourly labour compensation as employees, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.7 | 5.4 | 0.6 | 1.9 | -8.5 | -1.9 | -1.3 | 8.3 | 6.5 | 0.79 |
| Mining and quarrying | 5.0 | -8.5 | -9.0 | 1.1 | -5.2 | 6.7 | -1.9 | -3.1 | 9.0 | -0.85 |
| Manufacturing | 1.6 | 0.5 | 2.4 | 2.8 | 6.3 | -0.3 | 1.7 | 0.7 | 4.0 | 2.19 |
| Electricity, gas and water supply | 4.7 | -7.8 | -1.2 | -1.5 | 4.7 | 5.4 | 12.2 | -0.2 | -0.8 | 1.58 |
| Construction | -4.3 | -2.6 | 1.3 | 1.8 | 0.1 | -1.0 | -2.6 | -1.7 | 1.9 | -0.82 |
| Trade, hotels, restaurants and repair | 1.9 | 8.0 | 4.0 | 3.9 | 2.8 | -1.6 | -0.5 | 3.6 | 4.5 | 2.92 |
| Transport, storage and communication | 1.0 | 5.8 | 6.5 | 2.0 | 4.7 | 1.6 | 4.1 | 3.6 | 4.4 | 3.76 |
| Financial and business activities [1] | 0.6 | 0.5 | -0.8 | -0.6 | -2.4 | 0.7 | -2.6 | 1.0 | 3.3 | -0.04 |
| Care and other service activities | -0.2 | -1.5 | -0.8 | 0.1 | 1.1 | -0.4 | 0.9 | -1.6 | -0.3 | -0.31 |
| business sector | 0.8 | 1.5 | 1.4 | 1.5 | 1.3 | 0.0 | 0.0 | 1.2 | 3.3 | 1.22 |

[1] excluding real estate services

Table 6. Gross-output based TFP change, including no holding gains in the user cost of capital, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.5 | 1.2 | -4.3 | -1.4 | -0.8 | 4.0 | 3.1 | 0.27 |
| Mining and quarrying | 1.6 | -6.8 | -6.5 | 0.8 | -5.2 | 3.5 | -1.1 | -1.0 | 5.1 | -1.17 |
| Manufacturing | 0.6 | 0.1 | 0.8 | 1.0 | 2.1 | 0.0 | 0.6 | 0.3 | 1.3 | 0.75 |
| Electricity, gas and water supply | 1.9 | -2.9 | -0.3 | -0.4 | 1.9 | 1.9 | 4.0 | 0.0 | -0.4 | 0.60 |
| Construction | -1.8 | -0.9 | 0.6 | 0.9 | 0.1 | -0.4 | -0.9 | -0.7 | 1.0 | -0.25 |
| Trade, hotels, restaurants and repair | 1.0 | 4.1 | 2.1 | 1.9 | 1.3 | -1.0 | -0.4 | 2.3 | 2.7 | 1.55 |
| Transport, storage and communication | 0.6 | 3.0 | 3.3 | 1.0 | 2.4 | 0.8 | 2.1 | 1.9 | 2.4 | 1.96 |
| Financial and business activities [1] | 0.6 | 0.5 | -0.5 | -0.3 | -1.8 | 0.5 | -1.6 | 0.9 | 2.4 | 0.07 |
| Care and other service activities | -0.1 | -0.9 | -0.4 | 0.1 | 0.8 | -0.3 | 0.6 | -1.1 | -0.3 | -0.18 |
| business sector | 0.7 | 1.0 | 0.9 | 1.1 | 0.9 | 0.0 | 0.0 | 0.9 | 2.3 | 0.86 |

[1] excluding real estate services

Table 7. Value-added based TFP change, including no holding gains in the user cost of capital, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.3 | 5.1 | -0.7 | 2.3 | -7.7 | -2.9 | -1.6 | 8.1 | 6.1 | 0.61 |
| Mining and quarrying | 5.0 | -8.4 | -9.0 | 1.3 | -5.1 | 6.7 | -1.8 | -3.0 | 9.1 | -0.77 |
| Manufacturing | 1.9 | 0.8 | 2.7 | 3.0 | 6.4 | -0.3 | 1.7 | 0.8 | 4.1 | 2.33 |
| Electricity, gas and water supply | 4.8 | -7.6 | -0.9 | -1.3 | 4.8 | 5.5 | 12.3 | -0.1 | -0.7 | 1.74 |
| Construction | -3.9 | -2.0 | 1.4 | 2.2 | 0.3 | -0.9 | -2.3 | -1.5 | 2.6 | -0.49 |
| Trade, hotels, restaurants and repair | 2.0 | 7.5 | 4.0 | 3.5 | 2.6 | -1.6 | -0.5 | 3.4 | 4.7 | 2.83 |
| Transport, storage and communication | 1.2 | 5.8 | 6.6 | 2.1 | 4.7 | 1.6 | 4.1 | 3.7 | 4.7 | 3.81 |
| Financial and business activities [1] | 0.8 | 0.8 | -0.5 | -0.4 | -2.3 | 0.7 | -2.4 | 1.2 | 3.5 | 0.15 |
| Care and other service activities | -0.1 | -1.3 | -0.6 | 0.2 | 1.1 | -0.4 | 0.8 | -1.5 | -0.4 | -0.25 |
| business sector | 1.0 | 1.6 | 1.4 | 1.6 | 1.4 | 0.0 | 0.1 | 1.2 | 3.4 | 1.30 |

[1] excluding real estate services

Table 8. Gross-output based TFP change, including holding gains in the user cost of capital for all assets except transfer costs, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.6 | 1.1 | -4.3 | -1.5 | -0.8 | 4.1 | 3.1 | 0.25 |
| Mining and quarrying | 1.7 | -6.8 | -6.7 | 0.7 | -5.1 | 3.7 | -1.1 | -1.1 | 5.3 | -1.14 |
| Manufacturing | 0.5 | 0.1 | 0.7 | 0.9 | 2.1 | -0.1 | 0.6 | 0.2 | 1.3 | 0.69 |
| Electricity, gas and water supply | 1.8 | -3.1 | -0.4 | -0.5 | 1.8 | 1.9 | 4.0 | 0.0 | -0.4 | 0.55 |
| Construction | -1.8 | -1.0 | 0.5 | 0.8 | 0.0 | -0.4 | -1.0 | -0.8 | 1.0 | -0.30 |
| Trade, hotels, restaurants and repair | 0.9 | 4.0 | 2.0 | 1.7 | 1.2 | -1.1 | -0.4 | 2.3 | 2.7 | 1.47 |
| Transport, storage and communication | 0.6 | 3.0 | 3.2 | 0.9 | 2.3 | 0.7 | 2.0 | 1.9 | 2.4 | 1.91 |
| Financial and business activities [1] | 0.4 | 0.1 | -0.8 | -0.6 | -2.0 | 0.3 | -1.7 | 0.7 | 2.4 | -0.14 |
| Care and other service activities | -0.2 | -1.0 | -0.5 | 0.0 | 0.7 | -0.3 | 0.5 | -1.1 | -0.3 | -0.25 |
| business sector | 0.5 | 0.8 | 0.7 | 0.9 | 0.7 | -0.1 | 0.0 | 0.8 | 2.3 | 0.75 |

[1] excluding real estate services

Table 9. Value-added based TFP change, including holding gains in the user cost of capital for all assets except transfer costs, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.4 | 5.1 | -0.9 | 2.2 | -7.8 | -2.9 | -1.7 | 8.2 | 6.1 | 0.55 |
| Mining and quarrying | 5.1 | -8.5 | -9.3 | 1.1 | -5.1 | 6.8 | -1.8 | -3.1 | 9.2 | -0.82 |
| Manufacturing | 1.6 | 0.6 | 2.4 | 2.7 | 6.2 | -0.5 | 1.6 | 0.6 | 4.0 | 2.12 |
| Electricity, gas and water supply | 4.5 | -8.0 | -1.2 | -1.5 | 4.7 | 5.5 | 12.2 | -0.1 | -0.7 | 1.56 |
| Construction | -4.0 | -2.2 | 1.2 | 1.9 | 0.1 | -1.0 | -2.4 | -1.5 | 2.6 | -0.60 |
| Trade, hotels, restaurants and repair | 1.9 | 7.3 | 3.7 | 3.2 | 2.4 | -1.8 | -0.6 | 3.4 | 4.7 | 2.66 |
| Transport, storage and communication | 1.1 | 5.7 | 6.4 | 1.9 | 4.5 | 1.5 | 4.1 | 3.7 | 4.6 | 3.69 |
| Financial and business activities [1] | 0.5 | 0.3 | -1.1 | -0.8 | -2.6 | 0.5 | -2.6 | 1.0 | 3.4 | -0.17 |
| Care and other service activities | -0.2 | -1.5 | -0.8 | 0.0 | 1.0 | -0.5 | 0.8 | -1.6 | -0.4 | -0.36 |
| business sector | 0.8 | 1.4 | 1.2 | 1.3 | 1.2 | -0.2 | 0.0 | 1.1 | 3.3 | 1.12 |

[1] excluding real estate services

Table 10. Gross-output based TFP change, setting the real discount rate at 3 percent, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.5 | 1.2 | -4.4 | -1.4 | -0.8 | 4.1 | 3.1 | 0.26 |
| Mining and quarrying | 1.3 | -6.8 | -6.6 | 0.7 | -5.6 | 3.3 | -1.2 | -0.9 | 4.8 | -1.30 |
| Manufacturing | 0.5 | 0.0 | 0.7 | 0.9 | 2.1 | -0.1 | 0.6 | 0.3 | 1.3 | 0.70 |
| Electricity, gas and water supply | 1.8 | -3.0 | -0.4 | -0.6 | 1.8 | 1.8 | 3.9 | 0.0 | -0.5 | 0.51 |
| Construction | -1.8 | -1.0 | 0.5 | 0.8 | 0.0 | -0.4 | -0.9 | -0.7 | 1.0 | -0.29 |
| Trade, hotels, restaurants and repair | 0.9 | 4.0 | 2.0 | 1.8 | 1.2 | -1.1 | -0.4 | 2.3 | 2.7 | 1.47 |
| Transport, storage and communication | 0.6 | 2.9 | 3.2 | 0.9 | 2.3 | 0.7 | 2.0 | 1.9 | 2.4 | 1.88 |
| Financial and business activities [1] | 0.4 | 0.1 | -0.8 | -0.6 | -2.0 | 0.3 | -1.7 | 0.8 | 2.4 | -0.12 |
| Care and other service activities | -0.1 | -1.0 | -0.6 | 0.0 | 0.7 | -0.3 | 0.5 | -1.1 | -0.3 | -0.25 |
| business sector | 0.5 | 0.8 | 0.7 | 0.9 | 0.7 | -0.1 | 0.0 | 0.9 | 2.3 | 0.74 |

[1] excluding real estate services

Table 11. Value-added based TFP change, setting the real discount rate at 3 percent, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.4 | 5.0 | -0.6 | 2.2 | -7.9 | -2.8 | -1.6 | 8.2 | 6.1 | 0.57 |
| Mining and quarrying | 4.9 | -8.4 | -9.1 | 1.2 | -5.3 | 6.6 | -2.1 | -3.1 | 8.9 | -0.90 |
| Manufacturing | 1.7 | 0.6 | 2.5 | 2.7 | 6.2 | -0.4 | 1.7 | 0.8 | 4.1 | 2.20 |
| Electricity, gas and water supply | 4.9 | -7.7 | -1.2 | -1.5 | 4.7 | 5.4 | 12.0 | -0.2 | -0.8 | 1.60 |
| Construction | -3.9 | -2.2 | 1.3 | 2.0 | 0.2 | -1.0 | -2.4 | -1.5 | 2.6 | -0.58 |
| Trade, hotels, restaurants and repair | 1.9 | 7.3 | 3.7 | 3.3 | 2.4 | -1.8 | -0.6 | 3.4 | 4.7 | 2.68 |
| Transport, storage and communication | 1.1 | 5.6 | 6.4 | 1.9 | 4.6 | 1.5 | 4.1 | 3.6 | 4.6 | 3.70 |
| Financial and business activities [1] | 0.5 | 0.4 | -1.0 | -0.8 | -2.6 | 0.5 | -2.5 | 1.0 | 3.4 | -0.13 |
| Care and other service activities | -0.2 | -1.5 | -0.8 | 0.0 | 1.0 | -0.5 | 0.7 | -1.6 | -0.4 | -0.36 |
| business sector | 0.8 | 1.4 | 1.2 | 1.3 | 1.2 | -0.2 | 0.0 | 1.1 | 3.4 | 1.13 |

[1] excluding real estate services

Table 12. Gross-output based TFP change, setting the real discount rate at 5 percent, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.3 | 2.7 | -0.6 | 1.2 | -4.3 | -1.5 | -0.8 | 3.9 | 3.1 | 0.24 |
| Mining and quarrying | 1.9 | -6.8 | -6.6 | 0.7 | -5.0 | 3.6 | -1.1 | -1.3 | 5.3 | -1.13 |
| Manufacturing | 0.5 | 0.1 | 0.7 | 0.9 | 2.1 | -0.1 | 0.6 | 0.2 | 1.3 | 0.70 |
| Electricity, gas and water supply | 1.8 | -3.1 | -0.4 | -0.4 | 1.9 | 2.0 | 4.1 | 0.0 | -0.4 | 0.59 |
| Construction | -1.8 | -1.0 | 0.5 | 0.8 | 0.0 | -0.4 | -1.0 | -0.8 | 1.0 | -0.30 |
| Trade, hotels, restaurants and repair | 1.0 | 4.0 | 2.0 | 1.8 | 1.2 | -1.1 | -0.4 | 2.3 | 2.7 | 1.47 |
| Transport, storage and communication | 0.6 | 3.0 | 3.3 | 1.0 | 2.3 | 0.7 | 2.0 | 1.9 | 2.4 | 1.90 |
| Financial and business activities [1] | 0.5 | 0.2 | -0.8 | -0.6 | -1.9 | 0.3 | -1.7 | 0.8 | 2.4 | -0.11 |
| Care and other service activities | -0.2 | -1.0 | -0.5 | 0.0 | 0.7 | -0.3 | 0.6 | -1.1 | -0.3 | -0.24 |
| business sector | 0.6 | 0.9 | 0.8 | 0.9 | 0.8 | -0.1 | -0.1 | 0.8 | 2.3 | 0.76 |

[1] excluding real estate services

Table 13. Value-added based TFP change, setting the real discount rate at 5 percent, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.3 | 5.1 | -0.9 | 2.3 | -7.5 | -3.0 | -1.7 | 7.9 | 6.0 | 0.55 |
| Mining and quarrying | 5.1 | -8.5 | -9.0 | 1.1 | -5.1 | 6.7 | -1.8 | -3.2 | 9.2 | -0.82 |
| Manufacturing | 1.7 | 0.6 | 2.4 | 2.7 | 6.2 | -0.4 | 1.6 | 0.7 | 4.0 | 2.13 |
| Electricity, gas and water supply | 4.5 | -7.9 | -1.2 | -1.5 | 4.7 | 5.4 | 12.2 | -0.1 | -0.8 | 1.56 |
| Construction | -4.0 | -2.2 | 1.2 | 1.9 | 0.1 | -1.0 | -2.4 | -1.5 | 2.5 | -0.61 |
| Trade, hotels, restaurants and repair | 1.9 | 7.3 | 3.7 | 3.2 | 2.4 | -1.8 | -0.6 | 3.3 | 4.7 | 2.65 |
| Transport, storage and communication | 1.1 | 5.7 | 6.3 | 1.9 | 4.5 | 1.4 | 3.9 | 3.6 | 4.5 | 3.65 |
| Financial and business activities [1] | 0.6 | 0.4 | -1.1 | -0.8 | -2.6 | 0.5 | -2.6 | 1.1 | 3.4 | -0.12 |
| Care and other service activities | -0.2 | -1.4 | -0.8 | 0.0 | 1.0 | -0.4 | 0.8 | -1.5 | -0.4 | -0.35 |
| business sector | 0.9 | 1.4 | 1.2 | 1.4 | 1.2 | -0.2 | -0.1 | 1.1 | 3.3 | 1.13 |

[1] excluding real estate services

Table 14. Endogenous discount rates.

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 6.3 | 4.3 | 6.7 | 3.5 | 1.4 | 1.4 | 2.9 | -0.8 | -0.8 | -1.7 |
| Mining and quarrying | 23.2 | 26.0 | 25.8 | 19.4 | 14.7 | 22.5 | 28.9 | 24.0 | 24.2 | 27.1 |
| Manufacture of food products, beverages and tobacco | 14.6 | 14.4 | 13.9 | 13.7 | 14.6 | 13.5 | 14.2 | 15.2 | 16.6 | 18.4 |
| Manufacture of textile and leather products | 6.1 | 4.5 | 3.7 | 8.1 | 7.9 | 7.2 | 4.3 | 3.1 | 4.9 | 6.5 |
| Manufacture of paper and paper products | 2.1 | 1.3 | 2.8 | 2.1 | 1.3 | 3.1 | 4.2 | 3.8 | 3.2 | 5.0 |
| Publishing and printing | 15.7 | 16.0 | 15.9 | 16.9 | 19.0 | 17.4 | 15.7 | 13.1 | 12.1 | 15.2 |
| Manufacture of petroleum products | -2.1 | -0.8 | -2.7 | 5.9 | -2.8 | 6.4 | 13.8 | 10.3 | 18.5 | 25.5 |
| Manufacture of basic chemicals and chemical products | 12.9 | 11.2 | 12.3 | 11.1 | 10.0 | 10.5 | 10.9 | 11.4 | 11.2 | 11.8 |
| Manufacture of rubber and plastic products | 7.1 | 8.8 | 8.1 | 9.6 | 10.0 | 6.8 | 6.1 | 4.9 | 5.4 | 6.0 |
| Manufacture of basic metals | 9.2 | 4.8 | 6.6 | 6.9 | 1.0 | 8.5 | 0.5 | -0.4 | 3.5 | 9.8 |
| Manufacture of fabricated metal products | 11.2 | 12.7 | 11.7 | 12.5 | 12.1 | 10.1 | 9.6 | 4.7 | 3.4 | 8.8 |
| Manufacture of machinery and equipment n.e.c. | 10.9 | 12.4 | 16.4 | 13.8 | 8.3 | 16.9 | 12.1 | 11.5 | 13.2 | 19.7 |
| Manufacture of electrical and optical equipment | -1.1 | -4.2 | -6.5 | -3.7 | -2.3 | 6.2 | -7.3 | -17.6 | -14.9 | -13.3 |
| Manufacture of transport equipment | 2.0 | -0.7 | 7.4 | 14.7 | 16.4 | 13.2 | 13.9 | 10.6 | 9.6 | 13.7 |
| Other manufacturing | 3.9 | 5.2 | 5.0 | 5.7 | 7.4 | 7.4 | 8.4 | 6.1 | 5.3 | 5.2 |
| Electricity, gas and water supply | 3.4 | 3.6 | 2.5 | 3.5 | 3.2 | 2.4 | 3.3 | 5.9 | 6.7 | 5.6 |
| Construction | 21.9 | 20.5 | 19.7 | 19.1 | 23.0 | 26.9 | 28.4 | 28.6 | 27.9 | 30.4 |
| Trade and repair of motor vehicles/cycles | 7.4 | 11.0 | 10.2 | 17.6 | 22.5 | 21.5 | 21.1 | 24.0 | 21.4 | 20.1 |
| Wholesale trade (excl. motor vehicles/cycles) | 19.5 | 21.2 | 31.6 | 32.5 | 38.6 | 43.1 | 40.8 | 44.4 | 39.7 | 44.3 |
| Retail trade and repair (excl. motor vehicles/cycles) | 13.6 | 9.6 | 11.3 | 17.2 | 17.4 | 14.9 | 13.6 | 12.6 | 9.4 | 2.6 |
| Hotels and restaurants | 21.0 | 22.0 | 27.3 | 33.6 | 35.5 | 34.9 | 31.8 | 35.3 | 31.6 | 30.3 |
| Land transport | 4.3 | 3.3 | 5.4 | 8.4 | 8.1 | 7.8 | 8.7 | 8.0 | 7.6 | 7.4 |
| Water transport | -1.8 | -3.8 | 2.4 | 6.2 | -0.2 | -1.7 | 3.3 | 3.6 | 3.1 | 3.0 |
| Air transport | -0.6 | -3.6 | 3.9 | 4.7 | -0.8 | -2.6 | -6.3 | -3.5 | -10.9 | -12.5 |
| Supporting transport activities | 2.6 | 2.2 | 3.0 | 4.1 | 3.7 | 3.2 | 3.7 | 3.0 | 2.6 | 2.8 |
| Post and telecommunications | 9.8 | 10.3 | 11.5 | 11.8 | 8.2 | 5.7 | 5.0 | 10.3 | 15.4 | 16.6 |
| Banking | 27.2 | 23.4 | 17.5 | 9.6 | 9.5 | 7.5 | 6.9 | 15.3 | 22.9 | 25.0 |
| Insurance and pension funding | 11.0 | 11.1 | 10.6 | 11.4 | 10.7 | 9.5 | 13.1 | 10.1 | 21.7 | 24.4 |
| Activities auxiliary to financial intermediation | 10.2 | 28.1 | 51.7 | 66.0 | 60.3 | 53.8 | 40.8 | 21.5 | 28.3 | 28.6 |
| Renting of movables | 7.2 | 6.9 | 5.9 | 6.0 | 4.5 | 0.9 | 0.1 | -4.9 | -4.3 | -4.8 |
| Computer and related activities | 6.4 | 28.0 | 59.4 | 73.4 | 81.8 | 70.8 | 67.5 | 40.7 | 34.4 | 46.8 |
| Research and development | 3.6 | 4.0 | -1.4 | -5.2 | -8.5 | -9.2 | -5.5 | -5.9 | -6.4 | -3.0 |
| Other business activities | 33.7 | 41.3 | 37.0 | 32.0 | 33.4 | 30.2 | 34.5 | 24.4 | 16.9 | 18.3 |
| Health and social work activities | 9.0 | 7.3 | 8.8 | 7.6 | 7.9 | 9.8 | 11.2 | 13.9 | 13.3 | 11.4 |
| Sewage and refuse disposal services | 1.0 | 0.5 | 1.1 | 1.2 | 1.8 | 2.7 | 2.8 | 3.9 | 4.4 | 3.7 |
| Recreational, cultural and sporting activities | -12.1 | -6.7 | -1.4 | -2.4 | -0.3 | 2.0 | 3.5 | 7.0 | 5.7 | 4.9 |
| Private households with employed persons | - | - | - | - | - | - | - | - | - | - |
| Other service activities n.e.c. | 3.4 | 0.5 | 1.3 | 4.3 | 5.5 | 5.0 | 6.7 | 9.1 | 6.4 | 6.2 |

Table 15. Endogenous discount rates, using for self employed the same hourly income as employees.

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 1.6 | -0.5 | 1.8 | 0.8 | -2.9 | -6.2 | -4.1 | -7.9 | -7.1 | -8.1 |
| Mining and quarrying | 23.2 | 26.0 | 25.8 | 19.3 | 14.7 | 22.5 | 28.9 | 23.9 | 24.2 | 27.0 |
| Manufacture of food products, beverages and tobacco | 14.0 | 13.7 | 13.2 | 13.1 | 14.0 | 12.9 | 13.6 | 14.5 | 16.2 | 17.9 |
| Manufacture of textile and leather products | 4.8 | 2.9 | 2.0 | 6.8 | 7.4 | 6.2 | 3.3 | 1.7 | 3.3 | 4.7 |
| Manufacture of paper and paper products | 2.0 | 1.2 | 2.8 | 2.1 | 1.2 | 3.0 | 4.1 | 3.8 | 3.2 | 4.9 |
| Publishing and printing | 14.1 | 14.6 | 13.9 | 15.7 | 18.0 | 16.4 | 14.4 | 12.0 | 11.1 | 14.3 |
| Manufacture of petroleum products | -2.1 | -0.8 | -2.7 | 5.9 | -2.8 | 6.4 | 13.8 | 10.3 | 18.5 | 25.5 |
| Manufacture of basic chemicals and chemical products | 12.9 | 11.1 | 12.3 | 11.1 | 10.0 | 10.5 | 10.9 | 11.4 | 11.2 | 11.8 |
| Manufacture of rubber and plastic products | 7.0 | 8.7 | 7.9 | 9.4 | 9.9 | 6.8 | 5.9 | 4.7 | 5.3 | 6.1 |
| Manufacture of basic metals | 9.2 | 4.8 | 6.6 | 6.9 | 1.0 | 8.5 | 0.5 | -0.4 | 3.5 | 9.8 |
| Manufacture of fabricated metal products | 9.9 | 11.1 | 10.2 | 10.6 | 10.1 | 8.4 | 8.4 | 3.5 | 2.2 | 7.4 |
| Manufacture of machinery and equipment n.e.c. | 10.0 | 11.6 | 15.7 | 12.9 | 6.9 | 15.8 | 11.4 | 10.8 | 12.8 | 19.3 |
| Manufacture of electrical and optical equipment | -1.3 | -4.3 | -7.1 | -4.2 | -3.1 | 5.5 | -7.8 | -18.1 | -15.5 | -13.9 |
| Manufacture of transport equipment | 1.5 | -1.5 | 7.0 | 14.0 | 15.7 | 12.8 | 13.4 | 10.2 | 8.8 | 12.9 |
| Other manufacturing | 2.5 | 3.5 | 3.1 | 3.4 | 5.5 | 5.6 | 6.8 | 5.0 | 4.1 | 4.0 |
| Electricity, gas and water supply | 3.4 | 3.6 | 2.5 | 3.5 | 3.2 | 2.4 | 3.3 | 5.9 | 6.7 | 5.6 |
| Construction | 13.8 | 11.3 | 9.5 | 9.1 | 11.8 | 15.5 | 17.0 | 16.8 | 16.2 | 17.9 |
| Trade and repair of motor vehicles/cycles | -0.2 | 6.3 | 3.4 | 9.7 | 18.1 | 15.1 | 14.9 | 18.2 | 16.3 | 14.3 |
| Wholesale trade (excl. motor vehicles/cycles) | 14.0 | 15.7 | 27.4 | 27.8 | 34.5 | 39.4 | 37.5 | 41.5 | 37.1 | 41.6 |
| Retail trade and repair (excl. motor vehicles/cycles) | 4.9 | -0.1 | 3.1 | 9.4 | 10.3 | 7.8 | 6.3 | 6.0 | 3.1 | -4.1 |
| Hotels and restaurants | 5.0 | 2.3 | 10.3 | 15.6 | 12.7 | 16.9 | 15.1 | 18.2 | 16.9 | 15.5 |
| Land transport | 3.2 | 2.3 | 4.5 | 7.5 | 6.4 | 6.6 | 7.8 | 7.2 | 6.9 | 6.4 |
| Water transport | -5.4 | -7.3 | -1.0 | 2.6 | -3.0 | -4.5 | 0.4 | 1.4 | 1.6 | 1.5 |
| Air transport | -0.7 | -3.6 | 3.9 | 4.7 | -0.8 | -2.7 | -6.3 | -3.5 | -11.0 | -12.6 |
| Supporting transport activities | 2.3 | 1.8 | 2.6 | 3.8 | 3.4 | 2.9 | 3.3 | 2.8 | 2.4 | 2.7 |
| Post and telecommunications | 9.6 | 10.2 | 11.3 | 11.7 | 8.0 | 5.5 | 4.8 | 10.1 | 15.1 | 16.4 |
| Banking | 27.2 | 23.4 | 17.5 | 9.6 | 9.5 | 7.5 | 6.9 | 15.3 | 22.9 | 25.0 |
| Insurance and pension funding | 11.0 | 11.1 | 10.6 | 11.4 | 10.7 | 9.5 | 13.1 | 10.1 | 21.7 | 24.4 |
| Activities auxiliary to financial intermediation | -6.6 | 18.3 | 32.1 | 49.7 | 39.5 | 41.1 | 31.0 | 11.5 | 21.0 | 20.0 |
| Renting of movables | 6.6 | 6.3 | 5.4 | 5.5 | 4.0 | 0.4 | -0.2 | -5.3 | -4.6 | -5.1 |
| Computer and related activities | -10.0 | 11.8 | 40.6 | 55.3 | 67.1 | 58.9 | 56.5 | 29.1 | 22.4 | 31.0 |
| Research and development | 3.4 | 3.8 | -1.7 | -5.7 | -9.1 | -9.8 | -6.0 | -6.2 | -7.1 | -3.7 |
| Other business activities | 22.5 | 28.0 | 25.0 | 20.1 | 23.4 | 19.3 | 24.5 | 15.3 | 7.6 | 8.0 |
| Health and social work activities | 9.9 | 8.2 | 9.7 | 8.3 | 8.6 | 10.6 | 11.7 | 14.9 | 14.4 | 12.7 |
| Sewage and refuse disposal services | 0.9 | 0.5 | 1.1 | 1.1 | 1.8 | 2.6 | 2.8 | 3.9 | 4.4 | 3.7 |
| Recreational, cultural and sporting activities | -22.6 | -15.7 | -11.2 | -13.0 | -10.4 | -6.7 | -5.4 | -0.8 | -3.0 | -1.5 |
| Private households with employed persons | - | - | - | - | - | - | - | - | - | - |
| Other service activities n.e.c. | -1.2 | -5.0 | -4.5 | -1.8 | -0.2 | -0.7 | 0.0 | 3.1 | -1.3 | -0.2 |

Table 16. Gross-output based TFP change, using an endogenous discount rate, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.2 | 2.7 | -0.7 | 1.1 | -4.5 | -1.3 | -0.8 | 4.5 | 3.1 | 0.28 |
| Mining and quarrying | 4.4 | -7.1 | -7.0 | 0.7 | -3.4 | 5.2 | -0.6 | -2.9 | 7.6 | -0.47 |
| Manufacturing | 0.5 | 0.2 | 0.8 | 0.9 | 2.1 | -0.2 | 0.5 | 0.1 | 1.3 | 0.68 |
| Electricity, gas and water supply | 1.7 | -3.1 | -0.4 | -0.5 | 1.8 | 1.8 | 3.9 | 0.0 | -0.3 | 0.51 |
| Construction | -1.8 | -1.0 | 0.4 | 0.7 | -0.1 | -0.5 | -1.4 | -0.9 | 1.0 | -0.40 |
| Trade, hotels, restaurants and repair | 1.2 | 4.2 | 2.2 | 1.8 | 1.2 | -1.2 | -0.6 | 1.8 | 2.7 | 1.46 |
| Transport, storage and communication | 0.6 | 2.8 | 3.2 | 0.8 | 2.1 | 0.7 | 2.0 | 2.0 | 2.6 | 1.87 |
| Financial and business activities [1] | 0.7 | 0.3 | -1.1 | -0.9 | -2.0 | 0.2 | -2.0 | 0.9 | 2.7 | -0.16 |
| Care and other service activities | -0.1 | -1.0 | -0.5 | 0.0 | 0.7 | -0.3 | 0.6 | -1.1 | -0.4 | -0.23 |
| business sector | 0.6 | 0.9 | 0.7 | 0.8 | 0.7 | -0.2 | -0.2 | 0.7 | 2.4 | 0.71 |

[1] excluding real estate services

Table 17.Value-added based TFP change, using an endogenous discount rate, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.4 | 5.1 | -1.3 | 2.2 | -8.4 | -2.6 | -1.6 | 9.2 | 6.3 | 0.59 |
| Mining and quarrying | 5.6 | -8.9 | -8.8 | 0.9 | -4.8 | 6.9 | -0.8 | -3.7 | 10.0 | -0.59 |
| Manufacturing | 1.5 | 0.5 | 2.4 | 2.5 | 6.0 | -0.5 | 1.4 | 0.4 | 3.7 | 1.95 |
| Electricity, gas and water supply | 4.6 | -7.9 | -1.3 | -1.5 | 4.8 | 5.4 | 12.1 | 0.0 | -0.8 | 1.57 |
| Construction | -4.0 | -2.3 | 0.9 | 1.7 | -0.2 | -1.2 | -2.9 | -2.0 | 2.2 | -0.88 |
| Trade, hotels, restaurants and repair | 2.0 | 7.3 | 3.9 | 3.1 | 2.0 | -2.0 | -1.0 | 2.9 | 4.5 | 2.48 |
| Transport, storage and communication | 1.0 | 5.3 | 6.0 | 1.6 | 4.2 | 1.4 | 4.0 | 3.9 | 5.0 | 3.59 |
| Financial and business activities [1] | 1.0 | 0.4 | -1.5 | -1.3 | -3.0 | 0.3 | -2.9 | 1.2 | 3.8 | -0.24 |
| Care and other service activities | -0.2 | -1.4 | -0.7 | 0.0 | 1.0 | -0.4 | 0.8 | -1.5 | -0.5 | -0.33 |
| business sector | 0.9 | 1.3 | 1.0 | 1.1 | 1.0 | -0.2 | -0.3 | 1.0 | 3.4 | 1.02 |

[1] excluding real estate services

Table 18. Gross-output based TFP change, using an endogenous discount rate and giving self-employed the same hourly labour income as employees, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -1.5 | 2.7 | 0.5 | 0.8 | -5.6 | -0.2 | -0.5 | 5.3 | 3.5 | 0.53 |
| Mining and quarrying | 4.4 | -7.1 | -7.0 | 0.7 | -3.4 | 5.2 | -0.6 | -2.9 | 7.6 | -0.46 |
| Manufacturing | 0.5 | 0.1 | 0.8 | 0.9 | 2.1 | -0.1 | 0.5 | 0.1 | 1.3 | 0.69 |
| Electricity, gas and water supply | 1.7 | -3.1 | -0.4 | -0.5 | 1.8 | 1.8 | 3.9 | 0.0 | -0.3 | 0.51 |
| Construction | -1.9 | -1.2 | 0.5 | 0.7 | 0.0 | -0.5 | -1.3 | -0.9 | 0.8 | -0.43 |
| Trade, hotels, restaurants and repair | 1.2 | 4.6 | 2.4 | 2.1 | 1.4 | -1.1 | -0.5 | 2.0 | 2.6 | 1.63 |
| Transport, storage and communication | 0.5 | 2.9 | 3.2 | 0.9 | 2.2 | 0.8 | 2.1 | 2.1 | 2.6 | 1.90 |
| Financial and business activities [1] | 0.7 | 0.4 | -0.8 | -0.7 | -1.8 | 0.4 | -2.0 | 0.9 | 2.6 | -0.06 |
| Care and other service activities | -0.1 | -1.0 | -0.5 | 0.1 | 0.7 | -0.3 | 0.7 | -1.1 | -0.3 | -0.19 |
| business sector | 0.6 | 1.0 | 0.8 | 0.9 | 0.8 | 0.0 | -0.1 | 0.8 | 2.3 | 0.79 |

[1] excluding real estate services

Table 19. Value-added based TFP change, using an endogenous discount rate and giving self-employed the same hourly labour income as employees, in percents.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | -2.8 | 5.2 | 1.0 | 1.5 | -10.4 | -0.4 | -0.9 | 11.0 | 7.1 | 1.09 |
| Mining and quarrying | 5.6 | -8.9 | -8.8 | 0.9 | -4.8 | 6.9 | -0.8 | -3.7 | 10.0 | -0.59 |
| Manufacturing | 1.5 | 0.4 | 2.4 | 2.7 | 6.1 | -0.4 | 1.5 | 0.4 | 3.6 | 1.99 |
| Electricity, gas and water supply | 4.6 | -7.9 | -1.3 | -1.5 | 4.8 | 5.4 | 12.1 | 0.0 | -0.8 | 1.57 |
| Construction | -4.3 | -2.6 | 1.1 | 1.6 | 0.0 | -1.1 | -2.8 | -2.0 | 1.8 | -0.94 |
| Trade, hotels, restaurants and repair | 2.0 | 8.0 | 4.1 | 3.7 | 2.4 | -1.8 | -0.8 | 3.2 | 4.4 | 2.76 |
| Transport, storage and communication | 1.0 | 5.5 | 6.2 | 1.6 | 4.3 | 1.6 | 4.2 | 3.9 | 4.9 | 3.65 |
| Financial and business activities [1] | 1.0 | 0.5 | -1.1 | -1.0 | -2.7 | 0.5 | -2.8 | 1.3 | 3.7 | -0.09 |
| Care and other service activities | -0.1 | -1.4 | -0.7 | 0.2 | 1.1 | -0.4 | 1.0 | -1.6 | -0.4 | -0.27 |
| business sector | 0.8 | 1.4 | 1.2 | 1.3 | 1.1 | 0.0 | -0.1 | 1.1 | 3.3 | 1.14 |

[1] excluding real estate services

Table 20. Domar factor calculated as the ratio between value-added based TFP change and gross-output based TFP change

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 1.85 | 1.86 | 1.36 | 1.90 | 1.81 | 2.01 | 2.00 | 1.97 | 1.92 |
| Mining and quarrying | 3.06 | 1.26 | 1.39 | 1.67 | 0.98 | 1.90 | 1.62 | 2.91 | 1.75 |
| Manufacturing | 3.34 | 13.17 | 3.29 | 2.94 | 2.94 | 5.41 | 2.72 | 3.07 | 3.09 |
| Electricity, gas and water supply | 2.56 | 2.63 | 3.06 | 3.04 | 2.54 | 2.80 | 2.95 | 47.81 | 1.81 |
| Construction | 2.17 | 2.26 | 2.48 | 2.50 | 4.27 | 2.43 | 2.53 | 2.02 | 2.49 |
| Trade, hotels, restaurants and repair | 2.01 | 1.78 | 1.87 | 1.83 | 1.96 | 1.57 | 1.40 | 1.46 | 1.73 |
| Transport, storage and communication | 1.88 | 1.88 | 1.95 | 2.05 | 1.94 | 2.00 | 1.97 | 1.87 | 1.90 |
| Financial and business activities [1] | 1.27 | 2.41 | 1.33 | 1.38 | 1.31 | 1.58 | 1.50 | 1.34 | 1.43 |
| Care and other service activities | 1.45 | 1.46 | 1.44 | 1.23 | 1.49 | 1.47 | 1.45 | 1.44 | 1.47 |
| business sector | 1.52 | 1.65 | 1.55 | 1.45 | 1.62 | 1.58 | 0.98 | 1.35 | 1.47 |

[1] excluding real estate services

Table 21. Domar factor calculated as the ratio between output and value added

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 1.87 | 1.92 | 1.83 | 1.91 | 1.98 | 1.96 | 1.97 | 2.03 | 1.99 |
| Mining and quarrying | 1.24 | 1.25 | 1.26 | 1.32 | 1.36 | 1.31 | 1.29 | 1.31 | 1.30 |
| Manufacturing | 2.73 | 2.81 | 2.93 | 2.85 | 2.86 | 3.00 | 2.97 | 2.88 | 2.82 |
| Electricity, gas and water supply | 2.55 | 2.58 | 2.80 | 2.66 | 2.61 | 2.95 | 3.03 | 2.60 | 2.54 |
| Construction | 2.20 | 2.25 | 2.26 | 2.24 | 2.23 | 2.22 | 2.18 | 2.10 | 2.07 |
| Trade, hotels, restaurants and repair | 1.66 | 1.70 | 1.69 | 1.69 | 1.68 | 1.69 | 1.70 | 1.68 | 1.67 |
| Transport, storage and communication | 1.81 | 1.86 | 1.85 | 1.85 | 1.93 | 2.00 | 1.99 | 1.92 | 1.88 |
| Financial and business activities [1] | 1.41 | 1.40 | 1.41 | 1.42 | 1.41 | 1.45 | 1.45 | 1.44 | 1.42 |
| Care and other service activities | 1.45 | 1.46 | 1.45 | 1.46 | 1.46 | 1.46 | 1.46 | 1.43 | 1.43 |
| business sector | 1.43 | 1.43 | 1.45 | 1.44 | 1.43 | 1.47 | 1.45 | 1.43 | 1.41 |

[1] excluding real estate services

Table 22. Ratio between the two versions of the Domar factor (Table 20 / Table 21)

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 0.99 | 0.97 | 0.75 | 0.99 | 0.92 | 1.03 | 1.01 | 0.97 | 0.97 |
| Mining and quarrying | 2.46 | 1.01 | 1.10 | 1.27 | 0.73 | 1.45 | 1.26 | 2.21 | 1.35 |
| Manufacturing | 1.22 | 4.68 | 1.12 | 1.03 | 1.03 | 1.80 | 0.92 | 1.07 | 1.10 |
| Electricity, gas and water supply | 1.00 | 1.02 | 1.09 | 1.14 | 0.97 | 0.95 | 0.97 | 18.39 | 0.71 |
| Construction | 0.98 | 1.00 | 1.10 | 1.11 | 1.91 | 1.10 | 1.16 | 0.97 | 1.20 |
| Trade, hotels, restaurants and repair | 1.21 | 1.05 | 1.11 | 1.08 | 1.17 | 0.93 | 0.82 | 0.87 | 1.04 |
| Transport, storage and communication | 1.04 | 1.01 | 1.05 | 1.11 | 1.00 | 1.00 | 0.99 | 0.98 | 1.01 |
| Financial and business activities [1] | 0.90 | 1.72 | 0.94 | 0.97 | 0.92 | 1.09 | 1.03 | 0.93 | 1.01 |
| Care and other service activities | 1.00 | 1.00 | 0.99 | 0.84 | 1.02 | 1.00 | 1.00 | 1.00 | 1.03 |
| business sector | 1.07 | 1.15 | 1.07 | 1.01 | 1.13 | 1.08 | 0.68 | 0.94 | 1.04 |

[1] excluding real estate services

Table 23. Value-added based TFP change based on output-based TFP change and the Domar factor

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 0.976 | 1.052 | 0.990 | 1.023 | 0.916 | 0.971 | 0.984 | 1.083 | 1.063 |
| Mining and quarrying | 1.020 | 0.916 | 0.918 | 1.009 | 0.929 | 1.045 | 0.985 | 0.986 | 1.066 |
| Manufacturing | 1.014 | 1.001 | 1.022 | 1.026 | 1.060 | 0.998 | 1.018 | 1.007 | 1.037 |
| Electricity, gas and water supply | 1.046 | 0.923 | 0.989 | 0.987 | 1.048 | 1.057 | 1.125 | 1.000 | 0.989 |
| Construction | 0.960 | 0.978 | 1.011 | 1.018 | 1.001 | 0.991 | 0.979 | 0.984 | 1.021 |
| Trade, hotels, restaurants and repair | 1.016 | 1.070 | 1.034 | 1.030 | 1.021 | 0.981 | 0.993 | 1.039 | 1.045 |
| Transport, storage and communication | 1.011 | 1.056 | 1.060 | 1.017 | 1.045 | 1.014 | 1.040 | 1.037 | 1.045 |
| Financial and business activities [1] | 1.006 | 1.002 | 0.989 | 0.992 | 0.972 | 1.005 | 0.975 | 1.011 | 1.034 |
| Care and other service activities | 0.998 | 0.985 | 0.992 | 1.000 | 1.010 | 0.995 | 1.008 | 0.984 | 0.996 |
| business sector | 1.008 | 1.012 | 1.011 | 1.013 | 1.011 | 0.998 | 0.999 | 1.012 | 1.032 |

[1] excluding real estate services