Federal Planning Bureau
Kunstlaan/Avenue des Arts 47-49, 1000 Brussels
http://www.plan.be

WORKING PAPER 6-11

Homogenising detailed employment data

April 2011

Bart Van den Cruyce, bv@plan.be

Abstract – In the national accounts labour inputs are collected by industry. Homogenising means transforming labour inputs by industry into labour inputs by product. This homogenisation is done using mathematical techniques. The paper compares the results for two well-known techniques (product technology and industry technology) and discusses the effects of homogenisation on Belgian data for the years 2000 and 2005.

Labour inputs are detailed by gender and education level. An additional distinction is made between employees and self-employed. The paper proposes a solution for the negatives problem that arises when applying the product technology model in the case of self-employed workers. It also assesses the plausibility of results by showing the effects of homogenising on wage costs and value added per head as well as on the ranking of industries by education level.

The product and the industry technology model yield significantly different results, most particularly for the employment use of wholesale and retail trade. The results of the product technology model are judged to be most plausible.

Jel Classification – C67, J21, J24

Legal deposit - D/2011/7433/9
Responsible publisher - Henri Bogaert

Executive Summary

In the national accounts (NA) a firm is allocated to the industry that corresponds to its main activity. Besides their main activity many firms perform secondary activities like wholesale, software development, R&D, real estate & rental services or restaurant services. These activities have their own industry, but are also performed outside it. Because firms often perform more than one activity, the industries in the NA are not homogeneous.

Homogenising means transforming a variable by industry into one by activity. Each activity (or product) is either a single good or a single service. All the key variables in the NA, including value added, wage costs and labour inputs per industry can be homogenised. This paper focuses on the homogenisation of labour inputs in terms of number of workers. It also reports on the effects of homogenisation on wage costs and value added per head. The provision of a homogenised series for labour inputs is a part of the obligatory programme for the transmission of the NA to Eurostat. The homogenised employment series appears as supplementary information below the Input-output table.

Besides the labour input data by industry, the only data requirement to generate homogenised labour inputs is a Make table. A Make table specifies each industry's output by product. Starting with this Make table, the homogenisation is done using mathematical techniques. The paper compares the results for two well-known techniques: product technology and industry technology. It discusses the effects of homogenisation on Belgian data for the years 2000 and 2005.

Workers have been subdivided by gender and education level and into self-employed workers and employees. These subdivisions lead to a multiplication of cells to be homogenised. In theory this can worsen the negatives problem that goes with the theoretically superior product technology model. The negatives problem has been reduced by isolating two special groups of workers: self-employed company administrators and temporary workers. Both groups are exclusively used in only one activity. For this reason they are better left out of the homogenisation process.

Both the product and the industry technology model lead to a fairly similar and stable ranking of industries with respect to the use of high skilled labour and value added and output per head. The product technology model tends to increase the differences between activities, while the industry technology model tends to reduce them. Thus activities that employ many (fewer) highly educated workers or more (fewer) female workers, do so even more (less) after being homogenised by the product technology model.

A similar result is obtained for the ratio of value added per worker and that of wage costs per employee. Thus, the activities with the highest value added per worker (e.g. Electrical energy, gas steam and water; Real estate and rental services and Refineries, pharmaceutical & chemi-

cals) have an even higher ratio after value added and workers have been homogenised using the product technology model.

When compared to their non homogenised industry some activities “gain” workers, other “lose” workers. The activities that “gain” most workers are Wholesale trade, Computer & related activities and R&D, Machinery, Electrical & equipment as well as Other community, social and personal services. Activities that “lose” workers are retail trade and public administration. This means that, in 2000 and 2005, the latter industries used workers to perform secondary activities.

When workers are detailed only by gender and education level, applying product technology leads to almost no negatives problem. Still, its results in terms of employment per activity are almost as far from the results for industry technology as from the original employment per industry data. The industry technology model results are judged implausible, mainly because they draw too many workers away from retail trade towards wholesale trade.

If a distinction between employees and the self-employed is introduced, using product technology leads to a negatives problem in the group of the self-employed, while industry technology results are implausible. Some of these negatives are caused by the presence of secondary market activities in non market industries. When performing these market activities, these industries do not use self-employed workers; however the product technology model does not recognise this.

To solve this problem, self-employed workers and employees with the same levels of education and same gender have been treated as perfect substitutes. When replacing negative values for self-employed workers with appropriate positive ones or zeroes, the results for employees are obtained as the difference between the homogenised series for all workers and that for self-employed workers. This approach yields plausible employment figures and plausible wages per head for employees.

Synthese

In de nationale rekeningen (NR) wordt een onderneming ondergebracht bij de bedrijfstak die beantwoordt aan haar hoofdactiviteit. Naast hun hoofdactiviteit hebben vele ondernemingen ook nevenactiviteiten zoals groothandel, softwareontwikkeling, O&O, immobiliën en verhuur of hotel en restaurant. Deze activiteiten hebben hun eigen bedrijfstak, maar worden ook voortgebracht buiten die bedrijfstak. Aangezien ondernemingen vaak meer dan één product vervaardigen, zijn de bedrijfstakken in de NR niet homogeen.

Homogeniseren is het transformeren van een variabele per bedrijfstak in een variabele per product. Elke activiteit (of product) is hetzij één goed of één dienst. Al de kernvariabelen in de NR, inclusief toegevoegde waarde, loonkosten en werkgelegenheid per bedrijfstak kunnen gehomogeniseerd worden. Deze paper behandelt de homogenisering van de werkgelegenheid in termen van aantal personen. Hij beschrijft ook de effecten van de homogenisering op de loonkosten en de toegevoegde waarde per hoofd. Het opstellen van een homogene werkgelegenheidsreeks is een onderdeel van het verplicht programma voor de overdracht van de NR aan Eurostat. Die reeks wordt als aanvullende informatie weergegeven onderaan de input-outputtabel.

Naast de werkgelegenheidsdata per bedrijfstak, is de enige datavereiste om homogene werkgelegenheidsdata te genereren een Maaktabel (tabel van binnenlandse productie). Een Maaktabel specificeert de output van elke bedrijfstak per product. Uitgaande van deze Maaktabel, gebeurt de homogenisering met behulp van wiskundige methodes. De paper vergelijkt de resultaten voor twee bekende methodes, producttechnologie en bedrijfstaktechnologie, en bespreekt de effecten van de homogenisering op Belgische data voor de jaren 2000 and 2005.

De werkgelegenheid wordt opgedeeld per geslacht en scholingsgraad en in de categorieën zelfstandigen en werknemers. Die opdelingen leiden tot een vermenigvuldiging van de te homogeniseren cellen. In theorie kan dat het probleem van de negatieve waarden, dat gepaard gaat met het theoretisch superieure producttechnologiemodel, verslechteren. Dat probleem werd beperkt door twee speciale groepen arbeidskrachten op te splitsen: zelfstandige bedrijfsbestuurders en tijdelijke werknemers. Beide groepen worden uitsluitend binnen één activiteit ingezet en worden daarom beter niet opgenomen in het homogeniseringsproces.

Zowel het producttechnologiemodel als het bedrijfstaktechnologiemodel bieden een redelijk vergelijkbare en stabiele classificatie van bedrijfstakken wat betreft de inzet van hooggeschoolde arbeid, toegevoegde waarde en productie per hoofd. Het producttechnologiemodel is geneigd de verschillen tussen activiteiten te vergroten, terwijl het industrietechnologiemodel ze eerder verkleint. Activiteiten waarvoor veel (minder) hoogopgeleiden of meer (minder) vrouwen worden ingezet, doen dat nog meer (minder) na homogenisering door het producttechnologiemodel.

Voor de ratio's van de toegevoegde waarde per werkende en van de loonkosten per werknemer wordt een vergelijkbaar resultaat verkregen. De activiteiten met de hoogste toegevoegde waarde per werknemer (bv. Elektriciteit, gas, stoom en warm water; Immobiliën en verhuur en Raffinaderijen, farmaceutische en chemische industrie) hebben dus een nog hogere ratio na de homogenisering van de toegevoegde waarde en werknemers op basis van het producttechnologiemodel.

In vergelijking met hun niet-gehomogeniseerde bedrijfstak "winnen" sommige activiteiten, waaronder groothandel, Informatica en aanverwante activiteiten en O&O aan tewerkstelling terwijl anderen, waaronder Kleinhandel en Openbaar bestuur aan tewerkstelling "verliezen".

In vergelijking met hun niet-gehomogeniseerde bedrijfstak "winnen" sommige activiteiten aan werkgelegenheid, terwijl andere er "verliezen". De activiteiten die het meest aan werkgelegenheid"winnen" zijn Groothandel, Informatica en aanverwante activiteiten en O&O, Machines apparaten en werktuigen, elektrische en elektronische apparaten, alsook Overige gemeenschapsvoorzieningen en sociale, culturele en persoonlijke diensten. De activiteiten die werkgelegenheid verliezen zijn Kleinhandel en Openbare besturen. Dat betekent dat die bedrijfstakken in 2000 en 2005 arbeidskrachten inzetten om nevenactiviteiten uit te voeren.

Wanneer werkgelegenheid enkel opgedeeld wordt per geslacht en scholingsgraad zorgt de toepassing van producttechnologie nauwelijks voor een probleem van negatieve waarden. De resultaten in termen van werkgelegenheid per activiteit liggen nochtans bijna even ver van de resultaten voor bedrijfstaktechnologie als de oorspronkelijke gegevens voor de werkgelegenheid per bedrijfstak. De resultaten van het bedrijfstaktechnologiemodel worden als ongeloofwaardig beschouwd met als voornaamste reden dat het te veel arbeidskrachten van kleinhandel naar groothandel overbrengt.

Wanneer een onderscheid wordt gemaakt tussen werknemers en zelfstandigen leidt de toepassing van producttechnologie tot negatieve waarden in de groep zelfstandigen, terwijl de resultaten van de bedrijfstaktechnologie niet plausibel zijn. Sommige negatieve waarden worden veroorzaakt door de aanwezigheid van secundaire marktactiviteiten in niet-marktdiensten. Voor de uitvoering van die marktactiviteiten doen die bedrijfstakken geen beroep op zelfstandigen, maar dat wordt niet onderkend door het producttechnologiemodel.

Om dat probleem op te lossen, worden de zelfstandigen en werknemers met dezelfde scholingsgraad en hetzelfde geslacht beschouwd als perfecte substituten. Wanneer de negatieve waarden voor zelfstandigen vervangen worden door de gepaste positieve of nulwaarden, worden de resultaten voor werknemers verkregen als het verschil tussen de gehomogeniseerde reeks voor alle arbeidskrachten en die voor de zelfstandigen. Die benadering levert plausibele werkgelegenheidscijfers en lonen per hoofd voor werknemers.

Synthèse

Dans le cadre des comptes nationaux (CN), les entreprises sont classées dans la branche d'activité qui correspond à leur activité principale. Beaucoup d'entreprises exercent également des activités secondaires, telles que le commerce de gros, le développement de logiciels, la R&D, l'immobilier, les services de location ou encore la restauration. Ainsi, bien qu'elles appartiennent à une branche d'activité spécifique, ces activités sont également exercées en dehors de celle-ci. C'est pourquoi les branches d'activité présentes dans les CN ne sont pas homogènes.

L'homogénéisation consiste à transformer une variable par branche en une variable par activité. Chaque activité (ou produit) représente un seul bien ou service. Les principales variables utilisées dans les CN, en ce compris la valeur ajoutée, les coûts salariaux et l'emploi par branche, peuvent être homogénéisées. La présente étude se concentre sur l'homogénéisation de l'emploi en termes de nombre de travailleurs. Elle analyse également les effets de l'homogénéisation sur les coûts salariaux et la valeur ajoutée par tête. Les séries homogénéisées d'emploi font partie du programme obligatoire de transmission des CN à Eurostat. Elles apparaissent au bas des tableaux entrées-sorties, au niveau des informations supplémentaires.

Pour générer des données homogénéisées d'emploi, il est nécessaire de disposer, d'une part, des données d'emploi classées par branche d'activité, et d'autre part, d'une matrice de la production intérieure. Cette matrice détaille la production de chaque branche d'activité par produit. Partant de cette matrice, l'homogénéisation est réalisée au moyen de techniques mathématiques. L'étude compare les résultats de l'application de deux techniques bien connues : la technologie produit et la technologie branche. Elle analyse également les effets de l'homogénéisation sur les données belges pour les années 2000 et 2005.

Les travailleurs sont répartis en plusieurs classes en fonction de leur sexe, de leur niveau de qualification et de leur statut (salarié ou indépendant). Cette ventilation a toutefois pour inconvénient de multiplier le nombre de cellules à homogénéiser. En théorie, ceci peut aggraver le problème des valeurs négatives, lié au modèle théoriquement supérieur de technologie produit. Le problème des négatifs a pu être atténué en isolant deux groupes spécifiques de travailleurs : les administrateurs d'entreprise indépendants et les travailleurs intérimaires. Ces deux groupes sont employés par une seule et unique branche d'activité. C'est pourquoi il est préférable de les exclure du processus d'homogénéisation.

Les deux modèles, basés respectivement sur la technologie produit et la technologie branche, donnent un classement relativement similaire et stable des branches, en ce qui concerne le recours à la main-d'œuvre qualifiée, la valeur ajoutée et la production par tête. Le modèle basé sur la technologie produit tend à accentuer les différences entre branches d'activité, alors que le modèle basé sur la technologie branche tend à les atténuer. La présence plus (ou moins) impor-

tante de travailleurs qualifiés ou de femmes dans certaines activités est renforcée après homogénéisation par le modèle de technologie produit.

Des résultats similaires sont obtenus pour le ratio de la valeur ajoutée par travailleur et celui des coûts salariaux par travailleur salarié. Ainsi, les activités présentant le ratio de valeur ajoutée par travailleur le plus élevé (par exemple l'électricité, le gaz et l'eau; les activités immobilières et les services de location ;les raffineries et l'industrie pharmaceutique et chimique) voient leur ratio augmenter suite à l'homogénéisation de leur valeur ajoutée et de leur les emploi par le modèle de technologie produit.

La comparaison des branches d'activité homogénéisées avec les branches correspondantes non homogénéisées, permet de constater que certaines d'entre elles « gagnent » des travailleurs, alors que d'autres en « perdent ». Les activités qui « gagnent » le plus de travailleurs sont le commerce de gros, l'informatique et activités connexes, la R&D, la fabrication de machines, de matériels électriques et d'équipements, ainsi que les services collectifs, sociaux et personnels. Les activités ayant « perdu » des travailleurs sont le commerce de détail et l'administration publique. Cela signifie qu'en 2000 et 2005, ces branches ont utilisé des travailleurs pour réaliser des activités secondaires.

Lorsque les travailleurs sont ventilés uniquement en fonction de leur sexe et de leur niveau de formation, la technologie produit ne débouche pratiquement sur aucune valeur négative. Néanmoins, les résultats en termes d'emploi obtenus avec la technologie produit sont pratiquement aussi éloignés des résultats obtenus avec la technologie branche que des données d'emploi des branches d'activités hétérogènes. Les résultats du modèle de technologie branche sont jugés peu vraisemblables en raison d'un glissement trop important de travailleurs du commerce de détail vers le commerce de gros.

Si l'on introduit une distinction entre les travailleurs salariés et les travailleurs indépendants, l'application de la technologie produit débouche sur des valeurs négatives dans le groupe des travailleurs indépendants, alors que l'application de la technologie branche donne des résultats peu vraisemblables. Certaines des valeurs négatives observées s'expliquent par la production d'activités secondaires marchandes par des branches non-marchandes. Ces dernières n'engagent pas d'indépendants pour les réaliser, ce dont le modèle de technologie produit ne tient pas compte.

Pour résoudre ce problème, il a été considéré que les travailleurs indépendants et les salariés ayant les mêmes qualifications et le même sexe pouvaient parfaitement se substituer les uns aux autres. Lorsque l'on remplace les valeurs négatives obtenues pour les travailleurs indépendants par des valeurs appropriées positives ou nulles, les résultats pour les travailleurs salariés correspondent à la différence entre les séries homogénéisées pour l'ensemble des travailleurs et celles pour les travailleurs indépendants. Cette méthode débouche sur des données d'emploi plausibles et des salaires par tête vraisemblables pour les travailleurs salariés.

Contents

List of tables

List of figures

1. Introduction

When product by product input-output tables are published, they are usually accompanied by a homogenised series of labour inputs. Such a series gives the direct employment use by product, and not by (heterogeneous) industry. In the European Union, this is a required supplement to the 5-yearly IO tables[1]. Labour inputs can be measured by employment (number of persons), jobs, total hours worked, or full-time equivalent employment.

Homogenised labour data are directly connected with a product by product input-output table. It is less straightforward to relate final demand products with labour input data by industry. Note that economic policy measures are more often defined in terms of activities (production of specific goods or services) rather than in terms of heterogeneous industries. Thus, with homogenised employment data, one can assess the possible impact of activity based measures more accurately.

When divided by the output per product, the homogenised labour data yield the direct employment multipliers[2]. Such employment multipliers are of greater interest if the labour inputs are differentiated according to skill, gender, age class or worker type (employees and self-employed, blue collar versus white collars etc.). The more subdivisions of workers provided, the greater the challenge to yield reliable homogenised labour inputs.

All that is needed to homogenise labour input by industry is a Make table. A Make table specifies each industry's output by product. Thus, homogenised employment data can be generated without an IO or a Use table. The techniques available to homogenise labour inputs are identical to those for homogenising intermediate use[3]. Yet only few authors have discussed these techniques in the context of labour inputs.

Koller (2006) discusses the homogenisation of employment data using commodity technology. The author tried to derive an employment by commodity matrix with a distinction between employees and self-employed en between jobs and full-time equivalents for Austria. He developed an Enhanced Almon method which is able to replace negative values generated in the context of commodity technology with predetermined positive values (unlike Almon where negatives are replaced by zeros). Koller's Enhanced Almon Method worked well to homogenise intermediate demand, but yielded implausible results - which the author chose not to publish - for wages and salaries per employee (job).

---

1 According to the obligatory transmission program, EU member states must send five yearly data on labour inputs by 60 homogenised branches to Eurostat in the context of symmetric input-output tables.

2 Post-multiplying this with the Leontief Inverse gives the total (absolute) employment multipliers, which also incorporate the indirect effects.

3 Chapter 11 of The Eurostat Input-outputmanual (2008) is devoted entirely to the methods for transforming the Supply and Use tables to symmetric input-output tables. These methods are not discussed in the context of labour inputs. The manual only states that labour inputs by industry should be provided on a yearly basis, whereas labor inputs per (homogenised) branch should accompany each 5 yearly input-output table (see Chapter 12).

Schaffer (2007) published homogenised data for hours worked and used them in combination with IO data to distinguish women's and men's contributions to final demand in Germany. The author only works with the distinction between men and women and does not mention how the detailed labour volume data have been homogenised. This could be done by using a commodity technology or an industry technology type of approach.

Van den Cruyce and Wera (2007) homogenise employment using industry technology. The authors provide some arguments why product or commodity technology could be less suited for homogenising qualitative employment data. These arguments involve the appearance of negatives and a weaker "technological" underpinning to homogenise certain qualitative labour inputs with commodity technology. These inputs are the workers age class and occupational status (self-employed or employees). These are thought to be more closely linked to firms or institutions than to products[4].

The main reason for applying industry technology was that it is the easiest way to generate consistent homogenised employment data (and corresponding employment multipliers) for an unrestricted number of worker categories. While the multiplier results obtained using industry technology were not implausible, it still feels bad not to have applied the theoretically superior commodity technology model[5].

This is particularly so if the worker categories involve education levels, since workers' education levels are more likely to depend on the goods and services produced than on the industry in which they are produced. The link between workers' education levels and products can be viewed as "technological". Although it is not as strict as that between certain raw materials and goods, it is clear that different products imply a different use of highly, medium of lowly educated workers. When distinguishing workers between gender or age class, this "technological" argument for applying product technology is weaker. But there is neither a theoretical justification for applying industry technology, that is: assuming that all the products in an industry are produced using the same number and mix of workers.

Although our labour input data by industry also distinguishes workers by age class, the homogenisation effort discussed here focuses on the formation level, gender and occupational status of persons employed. Workers are subdivided into employees and self-employed, men and women and in 6 formation levels. This already leads to a total of 24 categories of workers.

Section 2 describes the applied homogenisation methods. In addition, it summarizes some of the factors that invalidate commodity and/or industry technology in the context of labour input

4 One would not expect a strong technological link between products and workers' age. The same is true for their occupational status: market output can be performed by employees or by self-employed workers. Still, often large differences appear between industries in the use of these categories of workers. The causes of this can be historical (past growth patterns of industries influencing the age composition of the current group of workers) or institutional (e.g. the public sector does not work with self-employed but does produce market output).

5 Commodity technology is generally accepted as a superior technique for homogenising intermediate use. See Avonds (2007), Konijn (2002) and Eurostat (2008).

data and presents some solutions. In the following sections the homogenised employment results for industry and commodity technology are compared for the years 2000 and 2005.

Section 3 shows the results when workers are only detailed by gender and education levels. In this case, homogenisation using commodity technology does not lead to many negative values, which supports the theoretical arguments for applying commodity technology.

Section 4 introduces the additional distinction between employees and self-employed. Here the theoretical arguments for using commodity technology are weaker, and this is confirmed by the appearance of a large amount of negatives in the cells for self-employed workers. We present a solution based on commodity technology that respects the total employment results obtained in section 3.

Section 5 leaves the methodological discussion and focuses on the effects of homogenisation. It presents which activities "gain" workers from homogenisation and which "lose" when compared to the (non homogenised) industry. It also discusses the effects of homogenisation on the education level by as well as on the ratios of wages and value added per head.

2. Data and homogenisation methods

2.1. The data

The employment data used in this paper are obtained from the SAM-database This database, produced at the Federal Planning Bureau[6], contains qualitative labour data at a yearly basis for about 130 industries in the period 1999-2009. A description of the compilation method can be found in Bresseleers et al (2007).

The labour input data refer to number of persons working in their main profession and not to labour volumes in the sense of jobs, full time equivalents or hours worked. The data are consistent with the employment data by industry in the latest national accounts (published by the NAI in October 2010). The SAM-database allows to isolate temporary workers and self-employed administrators, which proved useful in the context of the homogenisation effort.

The employment data are represented further by the matrix S. The columns of this matrix represent industries, the rows worker categories. The number of industries equals that of the IO table in the corresponding year. Because there are 6 education levels, two sexes and a distinction between self-employed and employees, the maximum number of rows in the matrix S is 24. Table 2 in the appendix gives an example of a transposed S matrix. The table shows the number of persons employed by gender for 6 education levels in 2005. The rows of this transposed S matrix show 28 industries that are described in table 1 in the appendix.

Besides the employment data, the only data needed is the Make table of 2000 and 2005. A Make table is a detailed production table[7]. Its columns show the production by industry, its rows that by product. Usually, a make matrix is rectangular because there are more products than industries. In table 3 in the appendix we show the aggregated Make matrix for 2005 with 18 industries and 28 products[8]. The Make matrix will be represented by the symbol M further.

M has to be square to be able to apply commodity technology (see further). Therefore, the number of products is aggregated to equal the number of industries. In general, each aggregated product is the main product of one industry[9].

6 The SAM database can be accessed at the site of the FPB ("qualitative employment data for Belgium, 1999-2009"). One can find there the distinctions between gender, 4 formation levels, employees and self-employed and the age class of workers with a distinction between major industries.

7 The Make table is a part of the Supply table, which in addition to production also gives imports, distribution margins and taxes and subsidies by product. The Make tables used are those compatible with the national accounts published in October 2007 (table for 2000) and October 2010 (table for 2005).

8 The full Make Belgian matrix of that year consists of 318 products and 129 (heterogenous) industries.

9 In practice, there are exceptions to this rule, because of the existence of products (like cpa 10 and 13) without corresponding industry in Belgium. The 2005 Input-output table for Belgium consists of 131 branches.

To test the quality of the results, homogenised data on workers are compared with homogenised data on value added and wage costs. Numbers for the latter two variables are obtained from the NAI data published in 2007 an 2010.

2.2. The homogenisation methods

All matrices and vectors introduced here are transformations of the employment matrix S and the Make matrix M. We will further use the vectors q and g, which are the vectors of the output totals by product and industry respectively. g and q are related to M in the following way, with i a unit vector:

$$q = M \cdot i \tag{1}$$

$$g = M' \cdot i \tag{2}$$

We will also use the matrix of employment coefficients L, given by:

$$L = S \cdot \hat{g}^{-1} \tag{3}$$

The symbol ^ transforms a vector into a diagonal matrix.

If the employment matrix S is homogenised using *product (or commodity) technology*, the resulting homogenised employment matrix S_q is given by:

$$S_q = L \cdot C^{-1} \cdot \hat{q} \tag{4}$$

The matrix C in (4) is the product share matrix. Each cells represents a product's share in an industries output. It is given by:

$$C = M \cdot \hat{g}^{-1} \tag{5}$$

This model assumes that wherever a product is produced, the same input structure is used[10]. Here, the inputs are employment categories. So it is assumed that there exists a matrix of coefficients of employment to output by product that do not only hold for the whole economy, but for all industries in which a product is produced. This matrix L_q of employment coefficients by product is given by:

$$L_q = L \cdot C^{-1} \tag{6}$$

The only difference between equation (4) and (6) is the post-multiplication with the inverse of the diagonal matrix of (product) output totals.

10 For a derivation of the formulas (4) and (5) starting from the assumption that the input structure of a product is the same, whatever the industry where it is produced, see United Nations (1999), p 91-95.

Remark that there is no guarantee that the right hand side of equation (4) or (6) yields a matrix with only positive elements. In practice, the inversion of the matrix C can lead to a high number of small or bigger negative values. This is the well known "negatives problem" associated with the product technology model that is usually discussed in the context of homogenising the intermediate use for deriving the IO table itself (see Eurostat 2008, p 319-329).

If the employment matrix S is homogenised using *industry technology*, the resulting homogenised employment matrix S_q is given by:

$$S_q = L \cdot D \cdot \hat{q} \tag{7}$$

The matrix D in (4) is the market shares matrix. Its cells represent each industries share in the total output of each product. It is given by:

$$D = M' \cdot \hat{q}^{-1} \tag{8}$$

Here, M' is the transposed Make matrix, while $\hat{q}$ is a diagonal matrix of outputs by product.

Multiplying both sides of (7) with the inverse of $\hat{q}$ yields the employment coefficients in the case of industry technology:

$$L_q = L \cdot D \tag{9}$$

In the industry technology model it is assumed that all products made within the same industry use the same input structure. As a result, the labour input for producing a product are a weighted average of the labour inputs of the industries that produce that product; the weights are the market shares of each industry in the product. Expression (9) represents this weighting in matrix form (United Nations (1999), p 88).

In practice, however, the homogenisation will often be of a hybrid type. This implies usually that for most products commodity technology is imposed, but for some industries, industry technology is applied. In the hybrid technology model, the homogenised employment matrix S_q is given by:

$$S_q = L \cdot \left[C_1^{-1} \left(I - \widehat{D_2' \cdot i} \right) + D_2 \right] \cdot \hat{q} \tag{10}$$

The C_1 matrix and the D_2 matrix in (10) have the interpretation and dimensions of the C and D matrices in (5) and (8). In the matrix C_1, the columns that correspond to industries where industry technology is applied are set to zero; the rows that correspond to the main products of these industries are also set to zero. When computing the inverse of C_1, the rows and columns with zeros are left out, only to be put back on their place after the inversion.

The matrix D_2 only contains the cells of the D matrix that correspond to the elements in the Make table that have not been used in the matrix C_1[11].

Like for deriving the IO itself, for homogenising employment the pure commodity technology model (equation (4)) has not been used. Instead the hybrid model in (10) was used, where industry technology was applied only for a limited number of industries. In fact, the C_1 and D_2 matrices used in this paper were exactly those used when deriving the 2000 and 2005 input-output tables. Note that for deriving the IO tables, it suffices to replace the matrix L in (10) by the matrix of intermediate input coefficients B[12].

Both in 2000 and 2005, there were three reasons for applying industry technology in a limited number of cases[13].

The first reason is the existence of products without industries and industries without product in the Make and Use table. In that case it is impossible to apply commodity technology. In the Belgian tables for 2000 and 2005 this was the case for coal, lignite & Peat (Nace 10), crude petroleum and natural gas extraction (Nace 11), metal ores (Nace 13) and other entertainment non-market services (Nace 92.3). For the recycling (Nace 37) there was only an industry and no product.

The second reason is formed by the so called "analytical de-aggregations". If a secondary production in a certain industry poses a particular problem when applying commodity technology (large negatives), this secondary activity is isolated into a new homogeneous industry. The use of labour inputs for this activity has to be estimated from the basic source data.

These "analytical aggregations" have already been applied in the year 2000[14], but were particularly important in 2005, where they were introduced in 18 of the 130 industries of the Belgian Input-output table[15]. Each isolated secondary activity leads to an additional temporary industry in the Supply and Use table. The industry is temporary, because it disappears after homogenisation, since no new product has been created[16]. Technically, this is made possible by using industry technology. Because the inputs of the isolated secondary products are not mixed with those

---

11 For a formal derivation of the matrices C_1 and D_2, we refer to the unnumbered note written by Luc Avonds 29/11/02 on "nieuwe procedure berekening I/O", mimeo.

12 See Avonds, L., Deguel, V., Gilot, A., Hambye, C., Van den Cruyce, B., Wera, J. (2003), p 106-107.

13 These reasons are described mory extensively in Federaal Planbureau (2010).

14 In 2000 they were introduced in three industries: treatment and coating services of metal (Nace 28.5), Wholesale trade services of solid, liquid and gaseous fuels (Nace 5151) and Financial intermediation services (Nace 65).

15 In 2005 these industries included the coating services of metal (Nace 28.5) and wholesale trade services of solid, liquid and gaseous fuels (Nace 5151). They also included the Refining of petroleum products (Nace 23.2). For financial intermediation services (Nace 65) industry technology was applied. The analytical de-aggregations allowed to reduce the % of negative cells in the 2005-IO table with 1.2% (Federaal Planbureau (2010)). Pure industry technology lead to a further reduction of 0,2%. The final percentage of negatives was 2.2% (Federaal Planbureau (2010)).

16 Thus avoiding the need to determine the use of each isolated secondary product in all industries and final demand categories.

of the main products, as would be the case when applying straight industry technology, these de-aggregations yield results that are in between industry and product technology[17].

Finally, two industries were homogenised using industry technology. In 2000 these were the Refining of petroleum products (Nace 23.2) and the Retail trade of automotive fuel (Nace 50.5). In 2005 industry technology was applied to the Financial intermediation services (Nace 65) and Insurance and (private) pension funding services (Nace 66). This decision has been taken after observing that for these industries, commodity technology leads to very large negative values and no obvious analytical de-aggregation was possible.

In the remainder of the document, when we speak of commodity technology, it is the hybrid technology model of equation (10) that is referred to. Industry technology refers to the model in equation (7) for there is no technical difficulty for applying this model to all industries. Yet even industry technology has not been applied for all categories of workers. Two categories of workers have been separated off, because both commodity and industry technology are wrong in this case and an alternative is straightforward. This will be explained in point 2.3.

2.3. The treatment of categories that are only used in one activity

In general, a specific category of workers, say “female employees with a short type tertiary education”, can be used to perform any activity. Of course, the intensity by which a specific group of workers is used may vary widely across industries and activities as well as over time. These differences in intensities are treated as “technologies” in this paper.

However, for some specific worker categories we know that they can only be used in a specific activity. In the Belgian employment data for 2000 and 2005 this is the case for persons working for temporary employment agencies and for self-employed company administrators.

Table 4 in the appendix shows the temporary workers. In 2005 the number of such temporary workers is estimated at 97 thousand[18] on a total of almost 3.6 million employees. Temporary workers are to a much lower degree tertiary schooled than other workers.

All these temporary workers are employees of the industry with Nace 74.5. Besides temporary workers, this industry also employs other workers (in 2005 those were 43 thousand) which help provide its main or secondary activities. This industry’s main activities are labour recruitment services, placement services of personnel and the provision of personnel services. There is no separate product for the provision of temporary personnel services, and to make the situation even more complex, some of industry 74.5’s main activities are also offered by other industries.

17 For a more extensive explanation of these de-aggregations, see Avonds, L., Deguel V., Gilot, A., Hambye, C., Van den Cruyce, B. and Wera, J. (2003), p 118 and Federaal Planbureau (2010).

18 This number is an estimate and does not include all workers that could be viewed as temporary workers. For example, persons engaged by agencies that provide subsidised domestic services (like ironing or cleaning) are either put directly in the industry that corresponds to their activity or kept in industry 74.5 but treated as ordinary workers..

A similar situation arises for company administrators. In Belgium, business managers of a company (which is a firm with a corporate personality) are legally treated as self-employed. This implies that they have to pay the social security contributions of self-employed. In the national accounts, these company administrators are all regrouped in industry with Nace 74.14-74.15. Remunerations paid to self-employed administrators are treated as a cost (=an intermediate use) for other industries.

Among self-employed, the company administrators are a swiftly rising category. As can be seen in table 4 in the appendix, in 2000, there were 137 thousand self-employed administrators, while in 2005 their number has increased to 180 thousand. Company administrators are an important fraction of the self-employed. Table 4 also makes clear that the group has a specific composition. Compared to other self-employed, it has a higher proportion of male workers and has a smaller fraction of lower and lower secondary schooled workers.

Like in the case of temporary workers, the main activity of the industry 74.14-74.15 is not limited to the services of company administrators. It extends to all business and management consulting services, as well as management holding services. Besides all company administrators, the industry employs other self-employed (including self-employed assistants) and employees.

Temporary workers are only used in the supply service of temporary personnel and self-employed company administrators only perform management services to companies. Yet commodity and industry technology do not recognize that the use of a specific labour category is restricted to one product.

Applying commodity technology yields a negative use of temporary workers and self-employed administrators in the other products produced by the industries 74.5 and 74.14-74.15 and to undue positive uses of these workers in some other products.

A preliminary exercise for 2000 showed that the negatives problem is large. When applying commodity technology for company administrators, the sum of the absolute value of the negatives rose to 17.7% of the total number of self-employed administrators. The sum of the undue positive cells rose to 1.1% of all administrators. In the case of temporary workers, the sum of the absolute values of the negatives rose to 10.3% of all temporary workers. The undue positive values summed to a value of 0.7% of the total number of temporary workers.

Because of the dominance of the negatives in other products, the use of firm administrators by product 74.14-74.15, and the use of temporary workers by product 74.5 is overestimated when homogenising using commodity technology. Replacing the negatives by zeros and reallocating, which would automatically be done after applying equation (10), solves the negatives problem, but not that of the undue positive values. If the categories of temporary workers or administrators are not isolated, a lot of the negatives would be made invisible by the aggregation, and even the negatives problem would not be cured sufficiently.

When applying industry technology, one might not see that there is a problem because there are no negatives. Yet all the secondary products in the industries 74.5 and 74.14-74.15 will then wrongly be said to *directly* use temporary workers and self-employed administrators. Because the total use remains the same, this leads to an underestimation of the use of firm administrators and temporary workers by products 74.5 and 74.14-74.15.

To solve this problem it suffices to leave out both categories of workers from the homogenisation process and to directly place them in the correct commodity afterwards. Doing this particularly improved the series for self-employed when homogenised with commodity technology. Prior to any correction for self-employed administrators, the sum of the negatives amounted to 3.2% of the total number of self-employed. When self-employed administrators were isolated, the sum of the negatives declined to 1.5% of all self-employed[19].

We conclude that it is preferable to remove categories of workers that are only used in one activity from the homogenisation. They can be placed directly in the correct commodity. In the results discussed in sections 3 and 4 temporary workers and self-employed administrators have first been removed from the S matrix, and then replaced in the correct product afterwards.

2.4. Some features of commodity and industry technology

In this section we briefly discuss the reaction of commodity and industry technology to some features in the data. We first discuss two cases in which commodity technology is more correct. Afterwards we discuss cases in which none of both methods yield good results.

Frequent cases in which the commodity technology is most correct are:

1. Firms or local Kind of Activity Units (KAUs) classified in the wrong industries, but with correctly specified production.
2. Not isolated input categories used in only one activity.

A usually unavoidable error in the Make table is that of local KAUs classified in the wrong industries. A local KAU's groups all parts of a producer that are located in one site and contribute to the performance of an activity at the level of 4 digits of the Nace (Eurostat 2008, p 91). When making the Supply table, each firm should be subdivided in local KAU's that belong to a different industry.

In practice it may be impossible to obtain separate date on production, employment (and its composition), compensation of employees and intermediary consumption of these local KAU's. If the variables mentioned above are correctly specified at the firm level, all one can do is put them in the industry that corresponds best with the firm's main activity.

19 These percentages refer to the negatives when only the total number of self-employed was homogenised. If the homogenisation is done by gender and education level, the sum of the values of the negatives is higher.

Note that even firms may be temporarily classified in the wrong industry. This situation may arise if the activity of firms in national accounts is not automatically adjusted to the most recent information on their activities in surveys. This adjustment can be delayed for comparability with other accounts or with past years.

Since these firms or local KAU's are wrongly classified, their other characteristics, including their labour use, are like that of the industry they should make a part of. Therefore, applying commodity technology already solves this problem. Applying industry technology would lead to errors, because the weighted average of the employment use in all the industries that production a commodity is influenced by firms that do not produce it.

The case of input categories used in only one activity has already been discussed in section 2.3. We add it here because a situation may arise where it is not possible to isolate such categories of workers in the employment data. In that case, commodity technology has the advantage that it may reveal the problem through the negatives. The removal of the negatives will lead to a result that is likely to be more correct than simply applying industry technology.

Cases in which commodity nor industry technology are correct:

1. Firms classified in the wrong industries, with their production incorrectly attributed to the industry's main activities.
2. Firms engaged in secondary activities have specific features, in terms of size, use of self-employed workers etc.

Point 1 is another example of an error in the Make table. Here no solution is possible: even when applying commodity technology, one may still underestimate the differences in worker use between activities. Of course, industry technology cannot do any better. If it has the tendency to play down differences between activities, it can be expected to be even further away from reality than product technology.

If firms engaged in secondary activities have specific features, this undermines the industry technology model, which spreads all (labour) inputs evenly over the industry's different productions. The product technology model already assumes that firms engaged in secondary activities use different (labour) inputs than those that only perform the industry's main activity. In this model the inputs of a firm engaged in multiple activities are a mix of the inputs required in the different activities, with their production values as a weight. The special features referred to in point 2 could make the inputs of such firms deviate from this mix.

A special feature that may cause such a deviation is firm size. Firm size matters in this context because large firms tend to work with less self-employed workers than small firms and with a lower employment to output ratio. We do not prove this here, but remark that output equals value added plus intermediate use. Thus a firm has a low ratio of workers to output if it uses more intermediate inputs and/or realizes a higher value added per worker. All this is more likely in large firms, which is consistent with the observation that large firms pay higher wages[20]. The employment by output ratios, or simply the employment coefficients, are crucial when homogenising employment. The matrix L of employment coefficients directly makes part of the central formulas (4) and (7) of both technology models.

The employment coefficients vary widely between industries and products, as can be seen in table 10. The first two columns give the employment coefficients in the industry level data for 2000 and 2005. The next columns already give the results of equations (6) and (9) for the product and industry technology models. Note that manufacturing activities tend to have low employment coefficients, while agriculture and most service activities have high employment coefficients. Both technology models generate different employment coefficients by product.

The largest differences between both models are seen in retail trade and wholesale trade. The employment coefficients of wholesale trade and retail trade are already very different before homogenisation (in 2005 wholesale has an employment coefficient of 5.1, while retail has one of 13.8). After homogenisation with the industry technology model the differences are reduced (5.6 & 13.6), while they are increased with the product technology model (5.2 & 15.8).

Now consider the case in which large firms have a higher tendency to be involved in secondary activities. This could be particularly relevant in the retail and wholesale trade activities. First note from the Make table (table 3) that wholesale is an important secondary activity in the retail industry. In 2005, 14% of the total output of the retail industry is wholesale trade[21]. This wholesale activity is more often done by large firms[22]. Indeed, one would rather expect secondary wholesale trade to be realised in low priced supermarkets with a high turnover than in small shops.

Consequently retail traders with important secondary wholesale activities are expected to have a lower employment to output ratio than pure retailers. This directly invalidates the industry technology model. It only invalidates the product technology model if the retail trade firms with secondary wholesale trade activities also have lower employment to output ratio's than they should have in this model according to their product mix. This is less evident, given the large difference in employment coefficient between wholesale and retail trade. In any case, the industry technology model is invalidated more than the product technology model.

The size of firms is also related to the use of worker types, and the use of self-employed workers in particular. Large firms use no or only few self-employed workers. In 2005 only 10.7 % of the

---

20 In 2005, firms in industries C to K employing less than 10 workers had annual wage costs per head for male workers of 27.6 thousand €; while firms employing more than 10 workers had wage costs per head of 39.2 thousand € for male workers. (see Hendrickx, K., Hertveldt, B, Lopez-Novella M., Van den Cruyce, B., 2007, p 10) For female workers, the differences were even larger. Wage costs are an essential part of value added, and therefore also a determinant of the (required) output.

21 In table 3 the wholesale trade performed by retail traders amounts to 3.1 billion euro (as given by the cell of row G51, column G52. Devided by the total production of 21.9 billion (column total), this gives 14%. In the Make table of 2000 this share was even higher: 19% !

22 Structural survey data for 2000 show that large supermarkets report more wholesale activities than other shops.

workers in the wholesale industry are self-employed. In the retail trade industry their share is as high as 26%. Industry technology uses the overall employment coefficients in retail trade to determine the number and type of workers involved in wholesale trade within the retail industry. Therefore it will allocate too much self-employed workers to the part of the wholesale trade activity that is generated (mainly by large firms) in the retail industry.

In the example given above, the special features of firms with secondary activities result in an additional argument against using industry technology. But it can also work against product technology. Consider the case of secondary wholesale trade margins in manufacturing. Often multinational firms that have a production unit in Belgium also have it operate as a wholesaler responsible for the import and distribution of the products made abroad in their group[23]. For performing this secondary wholesale trade activity, such large firms will use less workers and certainly less self-employed workers than the average wholesaler.

Because employment to output ratios are usually lower in manufacturing than in wholesale[24] when applying product technology, negatives may appear in activities that correspond to manufacturing industries with secondary trade activities. This is particularly so in the case of self-employed workers. In 2005 10.7% of the workers in wholesale are self-employed, while this is only the case for 4.5% of the workers in manufacturing. Therefore, the product technology model will tend to draw away too much self-employed workers from manufacturing, leading to negatives.

Finally remark that an observation that large firms are more engaged in secondary activities could result from a pure registration problem. The smallest firms are excluded or underrepresented in the statistics underlying the Make table (like Prodcom and in Structural Survey). So if they have a secondary activity, it may not be included in the Make table. In that case, it is difficult to say which model is most invalided.

2.5. Applying commodity technology at the all workers level

A larger share of large firms in secondary activities could be an argument to work with the assumption that self-employed workers are only engaged in the main activities of their industry. In that case, the whole category of self-employed workers would not have to be homogenised while employees could still be homogenised using e.g. commodity technology.

Although this assumption is of course erroneous, summing the homogenised series for employees with the original non homogenised series for self-employed yields plausible results for total

23 A typical example of this is the car assembly industry. Many firms in this industry assemble cars, but also realize trade margins on the distribution of cars and car parts produced abroad. Even if the margins are small, the large volumes involved make the amounts considerable.

24 Out of 9 manufacturing industries (that all start with D) shown in table 10, there are only two that have a higher employment to output ratio than wholesale trade (G51). Still, with an employment coefficient of 5.1 in 2005 the employment use in wholesale is not that much higher than in most manufacturing industries.

employment. What we have described here is exactly the solution applied (and published) in 2003 to generate homogenised employment results for 2000. The homogenisation of employees was done using commodity technology.

This choice has the advantage that it yields plausible results and avoids the difficulties one encounters when homogenising data on self-employed (see further). Note also that for the large group of self-employed administrators we already proposed the same treatment (in point 2.3).

The drawback is that no homogenised series for self-employed is produced. This is painful in activities that are spread over several industries. It is also painful in those activities where industry and product technology yield results that diverge in the same sense from the non-homogenised figures. If no homogenised figures for self-employed are produced, there is also no real homogenisation of total employment. Homogenising total employment directly using commodity technology leads to a different result.

This is disturbing because self-employed workers and employees are often substitutes, particularly if one controls for characteristics as their gender and education level. The degree to which self-employed workers or employees are used depends on the type of firm. We already mentioned the difference between large and small firms. Firms are usually headed by a self employed worker. In a small firm of, say, 5 workers the use of self-employed workers is at least 20%. In a medium sized firm of 50 workers, that share drops to 2.5%. So holding the worker to output coefficient constant, large firms use less self-employed workers and more employees.

Another example of this substitutability is the performance of secondary market activities by institutions (either non profit or public) that belong to the non-market sector. Producers in the Belgian non-market sector do not work with self-employed, they only have employees. Yet the market sector may perform the same activity using self-employed.

Not homogenising the self-employed leads to errors in the results for all workers. This can be explained as follows. Private firms use both self-employed and employees to perform their activities. Therefore, their employment coefficient for employees (employees/output) is lower than in a public or non profit firm that performs the same activity but uses only employees.

As a result, commodity technology will withdraw too few employees from the non-market sector industries and too much from the private sector when generating the use of workers in the market activity performed in both sectors. At the same time, commodity technology will withdraw too much self-employed from the public sector (leading to negatives, because there are no self-employed) and too few from the private sector.

If data on self-employed and employees are not separated both errors compensate each other. If only the data on employees are homogenised, and self-employed are attributed directly to the market activity, the end result will reflect the errors made in the case of employees. Because too few employees have been withdrawn from the non market sector its use of employees and its total use of workers will be overestimated.

When applying product technology for self-employed workers in 2000 and 2005, negatives appeared in the industries that belong to the non-market sector in Belgium. These are, with their Nace code and the main secondary market activities causing the negatives between brackets:

- Railway transportation services (Nace 60.1; Construction and Postal & courier services)
- Public administration (Nace 75; Forestry, Real estate services & Other business services)
- Non-market education services (Nace 80; Restaurant services and Private education)
- Non-market social work services (Nace 85.3; Market health care)
- Non-market membership organisation services (Nace 91; Other business services)
- Library, archives, museums and other cultural services and non-market sporting services (Nace 92.6 and 92.6; Beverage serving services).

From the previous paragraph it is clear that the secondary market activities that cause the negative use of self-employed in these non market industries are not necessarily limited to their market variant. Thus, to solve the negatives problem, it does not suffice to aggregate non- market with similar market industries.

The negatives for self-employed mentioned above almost never lead to negatives in total numbers of workers. When added with the homogenised figures for employees they correctly reduce the use of workers in public activities. The idea that self-employed and employees can be substitutes, is the main reason why we prefer homogenising all workers using commodity technology over homogenising only employees.

The relation between output and all workers can be expected to be more robust than that between output and an institutionally determined category of workers. This view is confirmed by the large amount of negatives one finds not only if one homogenises self-employed in non market sectors, but also in a preliminary exercise for 2000 where employees are subdivided in private and public sector type of workers[25].

Therefore in cells where the commodity technology results for self-employed workers are corrected, the corresponding cells for employees will be adjusted so that the results for all workers can be maintained. Section 3 first discusses the results for all workers. The results for employees and self-employed workers are discussed in section 4.

---

[25] Private sector blue collar and white collar workers give rise to large negatives in a small number of cells corresponding to non market industries. As a mirror image of this civil servants and other public sector workers show small negatives in a large number of cells corresponding with market industries.

3. The results for all workers by gender & education level

This section shows the results for commodity technology model (in fact the hybrid technology model) without and with corrections (point 3.2) and those for the industry technology model (point 3.3). The section starts with a presentation of the non homogenised employment data.

The matrix calculations have been done at the level of 130 input-outputbranches[26]. For the sake of the presentation, these have been aggregated to 28 activities or homogenised industries. The description of these 28 activities is given in table 1.

3.1. The non homogenised employment data

The data and results are for all workers. Temporary workers and self-employed administrators are included in the data and results, but have been treated as explained in section 2.3.

The non homogenised employment data are interesting in their own right. They are directly comparable to the annual industry totals of output, value added and wages costs in the national accounts. One does not need an input-output table or a Make table to produce these data, which makes them more readily available.

The SAM database contains a series of detailed employment data by industry for Belgium for all the years between 1999 and 2009. Because of their availability, it is such employment data, and not the homogenised employment that are generally used for productivity analysis. Therefore it is important to verify if the homogenisation affects the ranking of industries in terms of workers education level or wages per head.

Table 2 shows the non homogenised employment data for 2005. It presents the full detail of 6 formation levels. To be able to report simultaneously on the results for 2000, the employment data is presented in a more aggregated way further on. In table 5 employment data for 2000 and 2005 are combined, but the worker formation levels are aggregated to three. There is a low formation level (primary education and lower secondary), a medium formation level (higher secondary and short type higher education) and a high formation level (long type higher education and academic education).

Table 5 shows that between 2000 and 2005, which is a relatively short time period, the employment composition of the Belgian economy has changed considerably. This was the case both for employment by industry as for the formation level of workers.

26 As a consequence of the analytical de-aggregations (see part 2.2), the Make tables do not hold 130 industries, but 144 and 154 industries in 2000 and 2005. Once the homogenisation is done, the dimensions fall back to 130.

Total employment decreases in agriculture and manufacturing (manufacturing industries start with D, see table 1), and increases in service industries and in the whole economy. In 2000, 42% of all the workers were women; in 2005 their share rose to 44%.

The formation level of female and male workers has increased mainly as the result of a shift from low to medium formation levels. The share of medium formation levels rose from 58% to 62% for women and from 48% to 54% for men. The share of low formation levels declined, while that of workers with a high formation level increased mildly with 1%. The industries with most workers with a high formation level are Computer and related activities & research and development (K7273), Education services (M) and Financial intermediation services (J).

Note that within industries formation levels may differ significantly by gender. In the swiftly growing Health and social work services (N) the share of male workers with a high formation level is over 40% in 2000 and 2005, while that of female workers is only 15% in 2000 and 14% in 2005[27]. A similar overrepresentation of highly educated male compared to women can be seen in the Education services (M) and Financial intermediation services (J).

To show the evolutions of employment and formation level by industry in a longer time period, table 6 gives the same data, but now for the years 1999 and 2009. The evolutions of employment and worker formation levels by industry shown in table 6 confirm those reported in table 5.

Note that table 6, like table 5, shows industries in which the share of highly schooled workers drops over time. An example is the Health and Social Work industry (N) where male highly schooled workers have seen their share decline from 43% in 1999 to 39% in 2009. Because employment in this industry is growing rapidly, this only means that the employment of highly schooled male has grown more moderately than that of medium schooled male workers.

3.2. The results for the commodity technology model

Table 7 shows the homogenised employment data of the hybrid model for 2000 and 2005.

First compare these results with the non homogenised data for 2000 and 2005 in table 5. The last row of table 5, with the total per labour category, should remain unchanged, since the homogenisation may not change the use of a labour category in the whole economy. The employment by *product* (or homogenised industry) in table 7 should differ from that by industry in table 5. An exception is the activity/industry P (private households with employed persons) of which all non-diagonal elements in the Make matrix are zero.

The number of workers per industry (table 5) and product (table 7) differ visibly for the 28 activities presented in the tables. In contrast to this, the share of female workers and the distribu-

27 From table 2 it can be derived that in 2005 33% of the women and only 22% of the men employed in industry N have the tertiary short type formation level. This group makes part of the medium education levels in table 5. This may nuance the difference between male and female workers somewhat, but does not remove it.

tion of the formation levels seems hardly affected by the homogenisation. The differences in composition between table 5 and 7 usually do not exceed one percentage. In some activities, like Real estate and rental services (K7071) and Computer and related activities & Research and development (K7273), the homogenisation has had a lager impact.

No corrections for negatives have been performed in table 7 and yet the table shows no negatives! This is caused by the aggregation. At the level of the IO branches and 6 formation levels, some negative cells do appear, but the number of these cells is very small. The total number of negative cells is 43 in 2000 and 16 in 2005 (compared to 1560 = 12 x 130 cells). The total absolute value of the negative cells equals resp. 0.14% and 0.04% of employment in 2000 and 2005[28].

The small number and size of the negatives is an argument in support of the validity of the applied hybrid model (and thus commodity technology) for these employment categories.

The negatives in the homogenised employment data were removed by replacing them with zeros. To avoid an increase in the economy wide use, this was compensated by reducing the employment use of the same labour category (e.g. primary schooled *female* workers) in a nearby input-outputbranch. The latter reduction was compensated by an increase in the use of a near employment category (e.g primary schooled *male* workers) which was itself (if possible) compensated in the original IO branch. This way the totals of employment use were maintained at the level of the homogenised IO industries.

Table 8 shows the results of the hybrid technology model with these corrections. A comparison with table 7 proves that there have been only few changes. The only visible changes have occurred in the Real estate and rental services (K7071), Computer and related activities & R&D (K7273) and Construction activities (F). The corrections have had almost no impact on employment totals per product.

This contrasts with the large impact of homogenisation on employment per industry. At the level of the 130 activities, the sum of the absolute values of the employment differences between the (non homogenised) industries and the (homogenised) activities after correction is 12.2% of total employment in 2000 and 11.1% in 2005. A high difference with non homogenised results does not imply that the homogenisation has a poor quality. It is simply a reflection of the heterogeneity in the underlying Make table.

All this implies that it makes a lot of difference if one works with homogenised or non homogenised employment data. There is also no guarantee that homogenised employment results for different years differ in the same sense with non homogenised results. Because of the importance of these issues, we will come back to them in section 5.

---

28 For calculating this percentage, we excluded self-employed administrators and temporary workers from the denominator since they are not included in the homogenisation process.

3.3. The results for industry technology

Table 9 shows the homogenised employment results from the industry technology model.

They can be compared with the non homogenised employment data in table 5. When considering employment for all 130 activities, the sum of the absolute values of the differences with non homogenised data now increases to 13.6% in 2000 and 12.7% in 2005. This is larger than the 12.2% and 11.1% mentioned earlier for the commodity technology model. If one compares table 9 and 5 there are now more differences that exceed 1% in the distribution by formation level and gender, particularly in the industries C, G50, G51, I6063, K7071, K7273 and O.

The sum of the absolute values of the differences between the commodity technology model with corrections and the industry technology model is 11% of total employment in 2000 and 8.9% in 2005. Although these percentages are lower than in the comparison with non homogenised data, they are an indication of remaining large differences.

The large difference between the two homogenisation methods in 2000 and 2005 is an important finding. It matters which homogenisation method is chosen! As can be seen by comparing tables 8 and 9, the commodity and industry technology models can lead to a different number of workers used by activity. The most significant differences between the two models can be found in the wholesale and retail trade activities.

In 2000 and in 2005 both models allocate more workers to wholesale than present in the non homogenised industry. But with 254 400 and 267 900 workers in 2000 and 2005, the difference between industry technology and the non homogenised data (only 208 600 workers and 218 800 in both years) is unusually high. The commodity technology model estimates the number of workers engaged in wholesale at 226 600 and 251 500 in both years.

The reverse situation exists for the retail activity. Here the industry technology model estimates the number of workers at 201 600 in the year 2000. This is as much as 93 200 workers less than the 294 800 workers in the retail industry in that year! In 2005 the industry technology model reduces the workers in the retail trade from 301 600 to 246 900, which remains a considerable reallocation. The commodity technology model (table 8) causes a more modest reallocation, and allocates 268 300 and 285 800 workers to retail trade activities in 2000 and 2005.

To understand what is behind these large differences, it is useful to compare the total employment coefficient in the retail trade and wholesale industry. In the first two columns of table 10, each industry's total employment coefficient[29] is given.

The employment coefficient of the retail trade industry is 15.2 in 2000 and 13.8 in 2005. The wholesale industry has employments coefficients of only 5.4 and 5.1 in these years. From the Make table of 2005 we know that the retail trade industry (column G52) has an important sec-

[29] This is the sum of the elements of the corresponding industry column in matrix L (equation (3)).

ondary wholesale activity (row G51). In 2000 there is a similar situation.

The industry technology model applies the high retail trade employment coefficient to all the activities performed in the industry, including wholesale trade. Therefore a lot of employment is withdrawn from the retail activity and put into wholesale. Consequently, the employment coefficients of the wholesale trade activity after using the industry technology model (the last two columns in table 10) are higher than those of the non homogenised wholesale industry, while the reverse holds for retail trade activity[30].

In contrast to this, the commodity technology model computes a common employment coefficient that holds for all the industries that have a retail activity. This results in a situation where the employment coefficient is higher in the retail trade activity (columns 3 & 4 of table 10) than in the retail trade industry (columns 1 & 2 of table 10).

It is more acceptable to have a higher employment coefficient in the retail activity than in the retail industry than the reverse. As put forward in part 2.4, the secondary wholesale trade activity of retail trade is likely to be concentrated in large retail firms that have lower employment coefficients.

Remark that the low employment coefficient of wholesale trade makes this activity much more comparable with manufacturing. The manufacturing activities have small employment coefficients ranging from 1.2 to 7.5 in the commodity technology model of 2005. Manufacturing and wholesale are also closely related to each other. It can be seen in table 3 that wholesale trade is the most important secondary activity for the manufacturing industries (D) (with a value of 6.9 billion euro) and that the wholesale industry has a secondary production in all manufacturing activities (see the elements in column G51 from DA to DN) with a total value of 5.1 billion euro.

[30] The latter is the result of the presence of retail trade as a secondary activity in industries G50 and G51.

4. The results for self-employed and employees

This section presents the results for self-employed and employees. Section 4.1 shows the results for self-employed, section 4.2 those for employees.

4.1. The results for self-employed workers

Section 4.1.1 discusses the treatment of the negatives in the case of commodity technology. In section 4.1.2 the commodity technology and industry technology results are compared.

4.1.1. The commodity technology results and the treatment of the negatives

Table 11 gives the non homogenised data for self-employed. Table 12 shows the results for self-employed when homogenised using the hybrid model without corrections. Table 14 gives the results of this model with corrections. Self-employed company administrators are included in activity K74 but treated separately as explained in section 2.3.

In the case of self-employed workers, the commodity technology model faces a negatives problem. For several of the 28 products in table 12, there is a negative use of self-employed workers. Negative numbers appear for Petro-chemical, nuclear & chemical products (DF+DG), Transport equipment (DM), Electrical energy, gas, steam and water (E) and Public administration, defence and compulsory social security (L). Table 12 also shows isolated negatives in some activities, like that of low skilled self-employed in Computer and related services; Research and development (K7273) and in Education services (M).

Remark that many of the negatives have already been removed by giving a proper treatment to self-employed administrators (see section 2.3). At the IO product level, the absolute value of the remaining negatives is 1.9% of the total of self-employed in 2000 and 1.8% in 2005[31]. These percentages may seem reasonably low, but the problem is the large number of negative cells. As much as 36% or 31% of all cells have a negative value in 2000 and 2005[32]. For some categories of self-employed, like women with academic formation, the share of negative cells rises to 44%.

To remove a large number of small negatives, one can make use of the method proposed by Almon (2000). This method replaces the negatives by zeros in a way that respects the commodity technology model as much as possible.

For some activities, replacing the negatives with zeros is the appropriate response. This is the

---

31 This percentage is computed as the sum of the absolute values of the negatives in all 12 categories of self-employed for all IO-products.

32 The smaller share of negatives in 2005 is partly caused by the larger number of industries in which “analytical de-aggregations” have been applied. These de-aggregated industries add to the number of cells in the denominator, but cannot be negative, because they are in the D_2 in stead of the C_1 matrix (see equation 10).

case for non-market activities that do not use self-employed. As can be checked in table 11, the industries E and L do not work with self-employed workers. The negatives in table 12 in the corresponding activities are caused by secondary market activities[33]. All negative uses of self-employed in non market activities have been replaced by zeros.

Negatives also appear in market activities. Here we agree with Koller (2006) that it would be unwise to replace all negatives with zeroes. An example is manufacturing. The negatives for self-employed in manufacturing are caused by the relatively large use of self-employed in its main secondary activities wholesale trade (G51), Computer and related activities; research and development (K7273) and other business services (K74)[34]. In 2005 the corresponding non homogenised industries had a share of 10.7% (G51), 10.3% (K7273) and 20.6%[35] (K74) of self-employed. These shares all exceed the 4.5 % of self-employed in manufacturing (D).

Where negatives appear, the commodity technology model has obviously withdrawn too much self-employed from the manufacturing activities. It does not suffice to replace negatives by zeros. It is desirable to have a positive use of self-employed in the production of manufactured goods. But how should those positive values be determined?

As discussed in part 2.5, plausible results can be obtained by simply taking the number of self-employed actually observed in the non homogenised industry. But this does not take into account that the production of a product can be (much) higher/lower than that of its corresponding main industry. Therefore, it is better to multiply the observed number of self-employed in an industry with the ratio of the product-output over the industry-output.

In practice the technique described above has been applied in only 5 of the 63 manufacturing industries in 2000 and in 12 in 2005. In 30 more manufacturing activities (and in 21 in 2005) a weighted average of this method and the commodity technology model was applied to generate a positive use of self-employed workers. This mixed method was also applied in a limited number of other market industries including Hotel services (Nace 55.1-55.2) and Other transport related activities (Nace 63.1/63.2/63.4) to generate a positive use of self-employed.

Because the total use of each category of self-employed has to remain unchanged, these corrections have to be compensated for in another activity. The larger corrections have been compensated by a decrease of the use of self-employed in one or more secondary activities that have caused the underlying negatives given the structure of the Make table. The remaining corrections were compensated by applying an overall adjustment factor (varying between 0.971 and 0.994 depending on the category of self-employed and the year).

---

33 Table 12 hides similar problems in other non market activities that make part of the larger aggregates Transport services (I6063), Research and Development (K73), Education services (M), Health and Social work services (N) and Other community, social and personal services (O).

34 To see these are important secondary activities in manufacturing, consult the column for industry D in table 3.

35 To compute the share of self-employed in industry K74 the 180.2 thousand company administrators and the 97.2 thousand temporary workers have been removed from the industry total of self-employed and workers since these categories were excluded from the homogenisation process.

Table 14 gives the results using product technology plus these corrections. It can be verified, by comparing tables 14 and 12, that the use of self-employed by manufacturing industries (DA to DN) is increased. As a result of this, there has been a small decrease of the use of self-employed workers in the other activities like Agriculture (A+B), Wholesale trade (G51) and Other business services (K74).

4.1.2. The comparison with the industry technology results

Table 13 shows the self-employed when homogenised using industry technology. It can be compared with the corrected commodity technology results in table 14. The largest differences are observed in wholesale and retail activities.

The industry technology model allocates 44.1 and 35.8 thousand self-employed workers to wholesale trade (G51) in 2000 and 2005, the corrected product technology model only 29.7 and 25.7 thousand. On the other hand, industry technology leads to a use of only 67.3 and 64.1 thousand self-employed workers by retail trade in 2000 and 2005, compared to 95.6 and 76.8 thousand in the corrected product technology model. For both activities, the results for industry technology are very far away from the non homogenised data in table 11.

Following the same reasoning as in section 2.4 and 3.3, we reject the results for the industry technology model. Most secondary wholesale margins generated in retail trade are due to large retailers that use fewer self-employed workers and have lower employment to output ratios[36].

For manufactured goods, the industry technology model generally yields a higher use of self-employed than the corrected product technology model. In this case, and in the case of market activities performed by public firms, it is not clear whether industry technology should be preferred over the corrected hybrid model. Yet the differences are small and therefore of less weight than those in the trade activities.

4.2. The results for employees

So far we have discussed the results for all workers and those for self-employed workers. The final results for employees, given in table 17, are obtained by taking the difference of the final results for all workers (table 8) and those for self-employed workers (table 14). The final results for employees in table 17 will not only be compared to the non homogenised data, but also to the uncorrected commodity technology results for employees.

Table 15 shows the non homogenised data for employees. The industry employment totals in that table equal those for all workers (table 5) minus those for self-employed (table 11). Table 16

[36] Note that even if firm size is held constant, the employment to output ratio is likely to be lower in a firm that works with employees compared to one that only works with self-employed workers. One reason for this is that self-employed pay less social security benefits than employees. Because these make part of wage cost, firms with employees are forced to realise a higher value added and output per worker.

shows the uncorrected commodity technology results for employees in 2000 and 2005. If these results are added with the uncorrected product technology results for self-employed (table 12), they yield the uncorrected product technology results for all workers (table 7).

In contrast to self-employed, the uncorrected product technology model works very well in the case of employees. Table 16 shows only one negative number: the use of low schooled male employees by activity K7071 in 2000. At the most detailed level (130 activities & 12 labour categories) there are only 11 cells with negative values in 2005 and 40 in 2000[37]. Most of these negatives have also caused negatives at the all workers level. Therefore removing the negatives at the all workers level usually resulted in resolving the problem for employees as well.

When deriving the results for employees as a difference between the corrected all worker and self-employed results, negative cells for employees can appear in cases where the number of self-employed has been augmented to a positive value. Usually the number of self-employed has been increased to zero or to a small positive number in activities with many employees. Therefore only very few new negative numbers appear for employees. At the level of the 130 input-outputactivities and 12 labour types no negative cells appeared in 2005 and only 5 in 2000. These have been removed by changing the all workers total slightly.

It is comforting to see, by comparing tables 16 and 17, that the directly homogenised results for employees do not differ much with the indirectly homogenised ones. At the level of the employment totals of 28 activities, there are modest differences that do not exceed 2%. These differences are related to those reported for self-employed between tables 12 and 14 (the uncorrected and corrected commodity technology model)[38]. The relative importance of the differences caused by the corrections for self-employed is smaller here, because with 3.4 and 3.6 million in 2000 and 2005 the employees are a much larger group than the 0.7 million self-employed. The differences in the composition of labour in terms of gender or formation level are even smaller: they usually do not exceed 1%.

In contrast to this, there are quite visible differences between the homogenised and non homogenised totals for employees by industry/activity. This can be seen by comparing employees per activity in tables 16 and 17 with employees per industry in table 15. The differences in employment are more outspoken in some activities, like construction work (F), trade & repair of motor vehicles, retail and automotive fuel (G50), wholesale trade (G51), retail trade (G52) and public administration & defence & compulsory soc. security (L).

---

37 12 of these negative cells occur in the real estate activity (activity K70) of which the data for 2000 are problematic.

38 The (uncorrected) employment totals of tables 16 and 12 should add to those of table 7; while the (corrected) employment totals of tables 17 and 14 should add to those of table 8.

5. The effects of homogenising employment

Up to this point, most attention went to the methodological aspects of homogenising employment. This section synthesizes the main effects of homogenising employment. In section 5.1 the focus is on the employment data themselves. Section 5.2 looks at the results when the homogenised labour data are combined with other homogenised data such as wage costs, value added and production.

5.1. The effects on employment data

Section 5.1.1 shows which activities "gain" and which "lose" employment after homogenisation. Section 5.1.2 treats the effects on the composition of the labour force by industry in terms of formation level and gender.

5.1.1. The employment "gains" and "losses" through homogenisation

Homogenising employment means reallocating employment by industry towards employment by activity or product. To show the magnitude of this reallocation, table 18 gives the "gains" or "losses" that each activity realises after homogenisation.

The table gives the differences between the homogenised and non homogenised employment both in thousands of workers and in percentage terms. The homogenisation results are those for all workers for the corrected product technology model and the industry technology model in 2000 and 2005.

The activities/industries are ordered by the employment "gains" in the case of product technology in 2005. From table 18 it follows that both in 2000 and 2005 four activities see their employment increased through homogenising by more than 10 000 workers. These activities are Wholesale trade and commission trade services (G51), Computer and related activities; Research and development (K7273), Machinery & equipment; Electrical & optical equipment (DK+DL) and Other community social and personal services (O).

The activities mentioned above are strongly present as secondary activities outside their main industry, as can be verified in the Make table for 2005, given in table 3. For all four activities, the product total of the output (the row total in table 3) exceeds the corresponding industry output total (the column total in table 3). Therefore it is not surprising that both the commodity and the industry technology model allocate more workers to these activities than the number that is working in their main industry.

The gains of these activities are also considerable when expressed as percentages of the employment in the (non homogenised) industry. If one is interested in the direct employment generated by these activities, the employment by the industry forms a serious underestimation!

It is also interesting to look at the activities that “lose” most workers through homogenising. These are Public administration & defence services, compulsory social security (L), Retail trade and repair services (G52) as well as Coke, refined petroleum products & nuclear fuels; Chemical products and Pharmaceuticals (DF+DG).

For the latter activity the commodity and the industry technology model lead to the opposite results. From table 10 we know that the (petro-)chemical industry has a very low employment to output ratio (of only 1.3 in 2005). The industry has secondary wholesale activities and performs other business services, while the production of chemical products is itself an important secondary product in the wholesale industry. In such a situation, the homogenisation hypothesis really matters. Despite our general preference for the commodity technology model, it is difficult to say which of both models is most correct in a particular case like this.

In most cases the homogenisation has the same effect in 2005 as in 2000, but there are some activities in which this is not so. In Education services (M) and Construction activities (F) the homogenisation leads to a gain in employment in 2000 and a loss in 2005. The reduction in the employment use by these activities if compared to their industries is confirmed by the results of the industry technology model. The reduction in the employment use of construction services is related to an increase in the employment use of Real estate and rental services (K7071).

The employment that is reallocated by the homogenisation is direct employment. The reallocation has nothing to do with indirect or cumulated employment. The latter is obtained when using the Leontief inverse and is not considered in this paper. Although care has been taken to isolate self-employed company administrators and temporary workers (all make part of activity K74), the results do not yet attribute those workers to the activity in which they are really used.

5.1.2. The effects on the worker formation levels

Figures 1 and 2 give for each of the 28 activities the share of male or female workers with a high formation level in 2005. These are workers that have completed a long term tertiary or an academic formation. For each activity the results of both homogenisation methods are compared with the non homogenised industry level data. The activities/industries are ranked according to the share of high schooled workers in the non homogenised industry.

Although there is no guaranty of this result at the start of the homogenisation, both homogenisation methods lead to a distribution of formation levels that is close to the original non homogenised one. There are only a few cases in which the original ranking of industries is changed. For some smaller groups of workers (like female workers in the transport equipment industry, DM) the product technology model leads to a different position.

Figure 1: The share of high skilled male workers by industry or activity in 2005

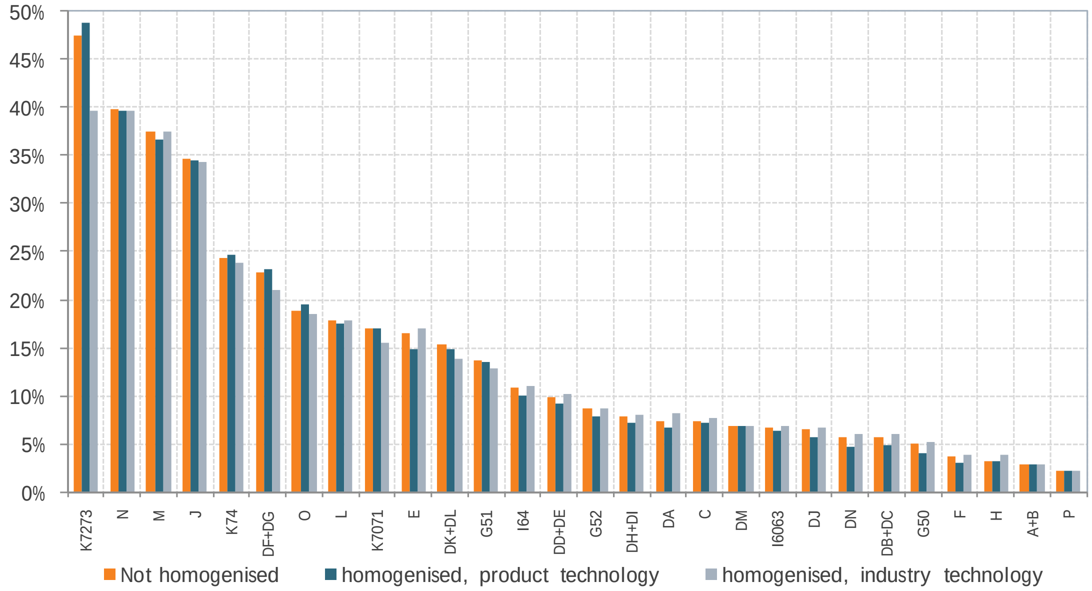
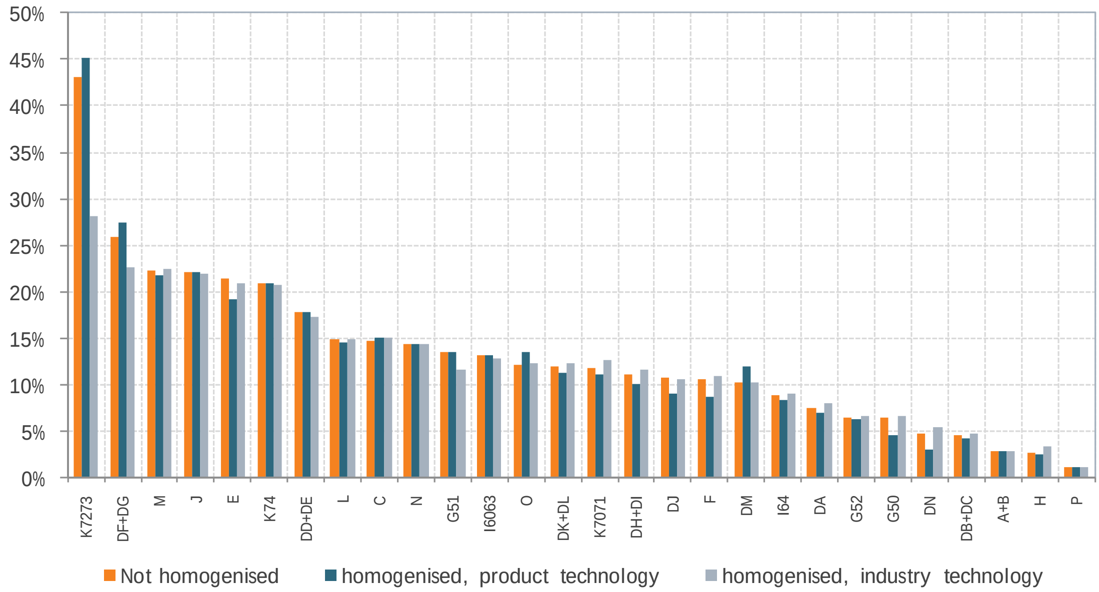


Figure 2: The share of high skilled female workers by industry or activity in 2005



The industry technology model leads to a lower share of high schooled male and female workers in the Computer and related activities & R&D (K7273) than the original industry data and the product technology model. From table 18 we know that the activity K7273 is one that "gains" workers from homogenisation. The workers allocated to this activity by the industry technology model have the low schoolings level of the manufacturing and other industries that perform this as a secondary activity. Because this is highly unlikely, the low use of high schooled generated by the industry technology model can be rejected.

In general one can observe that the product technology model tends to increase in the differences between the activities by (de-)increasing the share of high schooled in activities with (few) many high schooled, while the industry technology model tends to reduce them.

Note that the ranking of activities is not the same for male (figure 1) and female (figure 2) workers. This difference is maintained by the homogenisation. With 40% of high schooled, the Health and social work services (N) come in second position for men but only in the 10th position (with 14%) for women. For women the second place is taken by (petro-) chemical & pharmaceuticals industry (DF+DG), which only takes the 6^{th} place for male workers. The distribution of high skilled workers over activities is more equal for female than for male workers. For men there are 15 activities with less than 10% high schooled workers, for women there are only 10 or 11 of such activities. As a result, wholesale trade (G51) and retail trade (G52), the first employing twice as much high skilled workers, lay further apart for female than for male workers.

The figures discussed so far distinguish 3 formation levels. There are results up to 6 formation levels though. It is particularly interesting to make a distinction within the growing group of medium schooled workers. This group can be split up into Medium low (higher secondary schooling) and Medium high (short type tertiary schooling). Together with the levels of low formation (primary + lower secondary) and high formation (tertiary long type and academic) we now distinguish 4 formation levels. Figures 3 and 4 give the all worker results for these 4 formation levels for the corrected product technology model for 2000 and 2005.

The activities are ranked in decreasing order of the % of low schooled workers. The distribution over low, medium low, medium high and high formation levels depends very much on the activity. As the share of low schooled workers goes down, that of Medium high and high schooled workers tends to increase. The activities with the highest share of Medium high (or tertiary short type) schooled workers are Education services (M). These are followed by Computer and related activities and R&D (K7273), Health and social work services (N) and Financial intermediation services (J).

When comparing the formation levels of 2005 (figure 4) with those of 2004 (figure 3), one can see a significant drop in the share of workers with a low formation level. In 2000, 5 activities employed more than 50% and 14 activities employed more than 40% of low skilled workers. In 2005 the number of these activities has fallen to 1 and 7 respectively.

Figure 3: Formation level by product in 2000 (all workers, commodity technology)

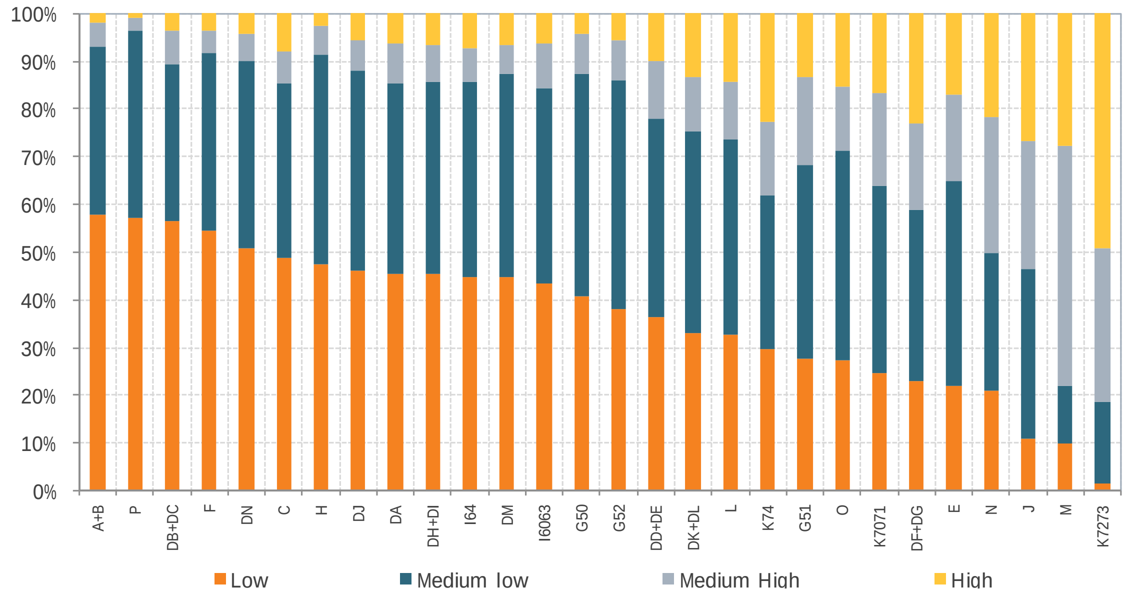
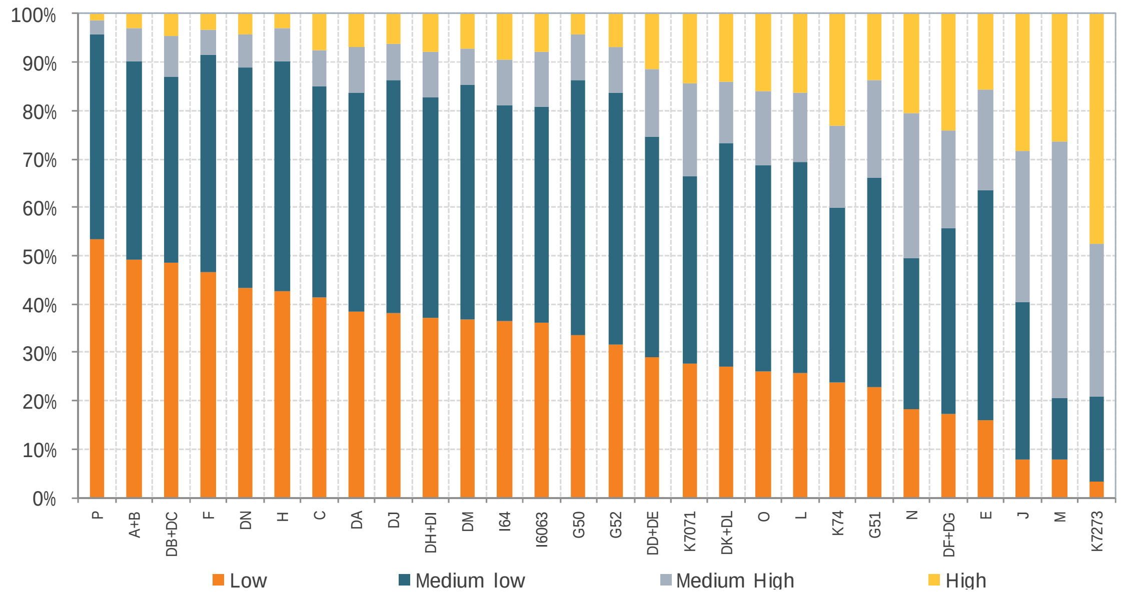


Figure 4: Formation level by product in 2005 (all workers, commodity technology)



In the 5 year period there have also been some changes in the ranking of activities. The Health and social work activity (N) has shifted to the left in 2005, because of a more moderate reduction in the share of low skilled workers. In terms of the use of tertiary schooled workers (adding Medium high and high formation levels) this activity still comes at the 4th place in 2005.

5.2. The relation with wage costs, value added and output

Section 5.2.1 first discusses wage costs per employee for 2000 and 2005. In section 5.2.2 value added and production per worker are shown for 2005.

5.2.1. Wage costs per employee

This paper describes a method to yield a homogenised series of self-employed workers as well as employees, while respecting the commodity technology results for all workers.

In the light of the difficulties Koller (2006) reports on producing plausible data of wage costs per employee when generating homogenised data for employees and self-employed, it is interesting to look at the wage costs per employee that result from our method.

Homogenised data for employees are compared with homogenised wage costs. Both for 2000 and 2005 homogenised wage cost (D1) are available at the industry level. As a part of value added, they have been homogenised using the hybrid technology model. In equation (10) the matrix L is replaced by the appropriate vector of wage costs[39] coefficients per industry.

It makes no sense to homogenise wage cost series using industry technology, because these wage costs would not be consistent with the other homogenised components of value added (consumption of fixed capital, net operating surplus & other taxes minus subsidies on production) and intermediate use. This is why, in figure 5 and 6, the non homogenised wage costs per employee are only compared with those where wages costs and employees are homogenised using the corrected product technology model (table 17)[40]. Figure 5 gives the wage costs per employees for 2000, figure 6 those for 2005.

The industries/activities in the figures are ranked in decreasing order of the annual wage costs per employee. The figures show that wage costs per head differ between the homogenised and not homogenised series, but the differences are relatively small. There are only a few cases in which the ranking is affected. The differences in wage costs per head are larger when wage costs are considered by product than by industry. This result is analogous to that found for the use of high skilled workers generated by the product technology model.

---

39 At this moment no comparable data on wage costs per worker type are available. Once such data are available, it is straightforward to compute homogenised wage cost data per gender and education level.

40 Remark that because we use the *corrected* homogenised results for employees (which compensate the adjustments done for self employed), it would be ideal to use homogenised results for wages that have undergone a similar correction. It is likely that the mixed income for self employed would also show undue negatives after homogenisation. However, the poor quality on the data for mixed income does not allow to perform such a correction.

Figure 5: Annual wage costs (D1) per employee in 2000 (in Euro)

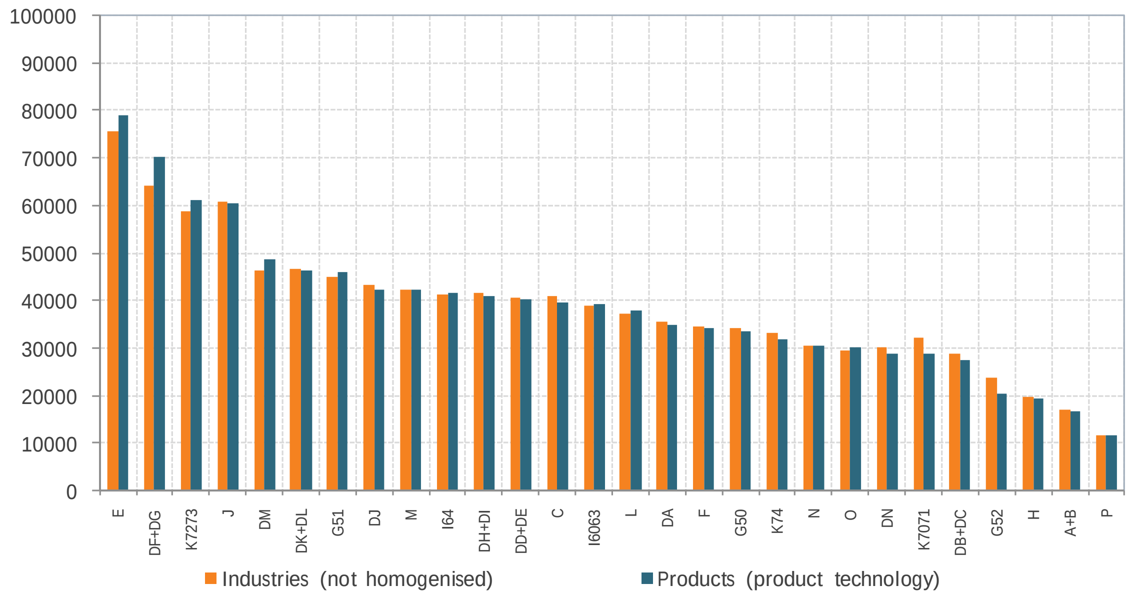
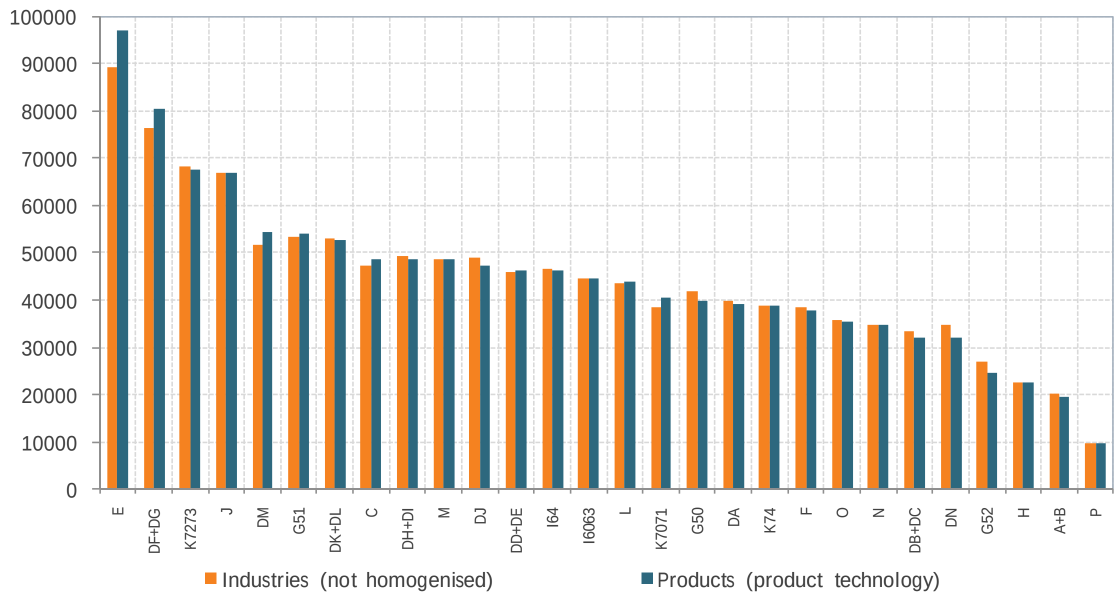


Figure 6: Annual wage costs (D1) per employee in 2005 (in Euro)



The results for wage costs are also consistent with those for education levels. The four activities with the highest wage costs per employee in 2000 and 2005 are Electrical energy, gas, steam & water (E), Coke, refined petroleum, nuclear fuels & chemicals (DF+DG), Computer and related services, Research & development (K7273) and Financial intermediation services (J). These activities are all among the top 5 in terms of the use of high skilled labour (figures 1 and 2).

The Education services (M) and Health and social work services (N) for men employ many high schooled workers, but only occupy a moderate or a low position in terms of wages per head for employees. For the Health services this is related to a tendency for high earning doctors and specialists to be self-employed, while less earning nurses are more often employees. As can be seen by comparing tables 14 and 17, self-employed male and women in activity N are mostly high schooled, while most employees have a medium schoolings level.

The activities with the lowest annual wage costs per head are Private households with employed persons (P), Agriculture, hunting, forestry & fishing (A+B), Hotel & restaurant services (H) and Retail trade & repair services (G52). The first two of these activities employ most low schooled workers while the latter two employ few high schooled workers (see figures 3 and 4).

Because of the absence of "odd" results (like large changes in the ranking when compared to non homogenised data) and because of the consistency with formation levels per activity we conclude that the homogenised wage costs per employee are plausible.

Remark that, with the exception of the Textiles, leather and their products (DB+DC) and Other manufactured goods (DN), manufacturing activities have moderate (Food products, beverages & tobacco: DA) or high wage costs (all others). The gap between Wholesale trade (G51) and Retail trade & repair services (G52) is even more pronounced for wages per employee than it was for formation levels. Wholesale trade pays more per employee than all but 3 manufacturing activities in 2000 and all but 2 in 2005.

5.2.2. Value added and output per worker

By analogy to wage costs for employees, it would be good to have a ratio of income for self-employed. Although figures of mixed revenues for self-employed at a detailed industry level exist, no homogenised series has been produced yet[41].

What can be done more readily is to compute the ratio of value added per worker, where workers include employees and self-employed. This can be done at the industry level (non homogenised data) or at the product level.

Figure 7 shows both ratios per activity for the year 2005. Value added was homogenised using the hybrid model, so that it makes most sense to use the series of workers homogenised by this model. However, to show the impact of the homogenisation method, figure 7 also includes results where the employment is homogenised using industry technology.

Wage costs are an important component of value added, but the latter also reflects depreciation of capital and the remuneration of capital and self-employed workers. As a result, the ranking of activities of wage costs per employee and value added per worker differ.

41 Mixed revenues for self-employed include rents and other revenues on capital. The rents lead to extremely high revenues for the industry real estate & rental services (K7071). When removing this industry, the data for mixed revenues continue to show instabilities over time at an aggregated industry level (like that exposed in this paper). Part of this instability is due to the growing group of self-employed company administrators, which has the effect of withdrawing self-employed and mixed revenues from their real industries towards the industry K74.

When comparing figure 7 with figure 6, one sees a remarkable increase in the rank of real estate and rental activities (K7071). The latter now occupy the second place. This activity profits from the fact that rental incomes are included in value added[42]. Remark also that Computer and related activities & R&D (K7273) fall out of the top 5, while other activities, including Wholesale (G51), maintain their position.

As usually, the differences between activities homogenised using product technology are more outspoken than those between industries or activities where employment is homogenised by industry technology. The homogenisation also has minor effects on the ranking. When workers are homogenised using product technology, the wage costs in postal & communication services (I64) drop slightly behind those paid in the activities G51 and K7273.

Figure 7 could be interpreted as an indicator for the effects of homogenisation on "labour productivity". The value of this ratio is relative, since it might be better to measure employment by their hours worked than by the (annual average) number of workers. Given the preference for the product technology results, figure 7 learns that the labour productivity differences between activities are larger than those between non homogenised industries.

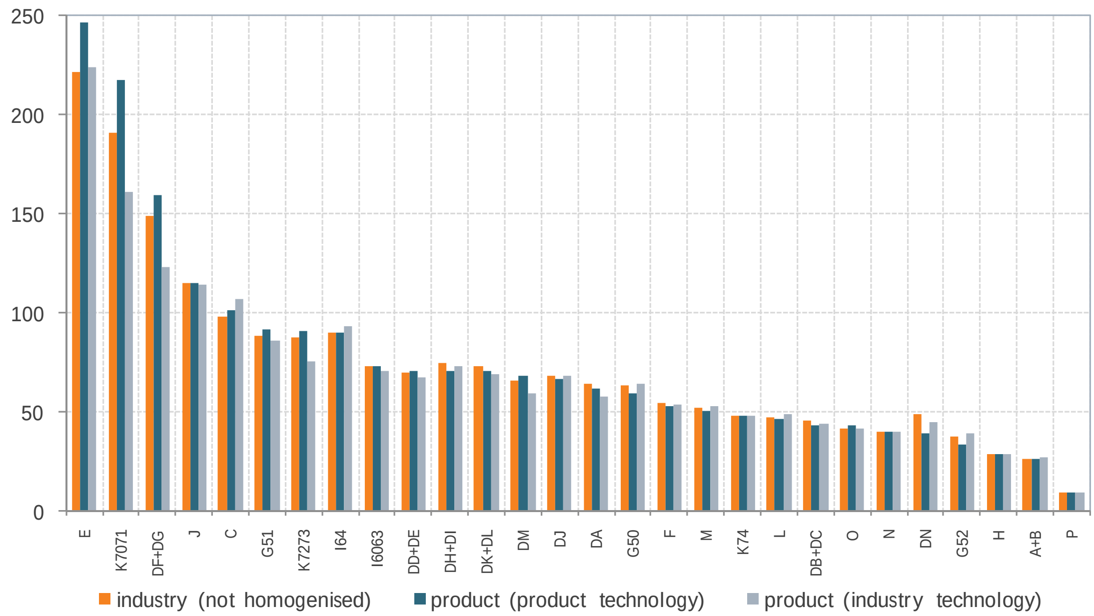
It is also possible to look at production per worker. In addition to value added, production includes the value of intermediate inputs. These include the cost of raw materials and services used in the production process. Note that in contrast to value added, the series for production (=output) does not have to be homogenised. It suffices to replace the output per industry (column totals in the Make table) by the output per product (row totals in the Make table) if one passes from industries to activities.

Figure 8 gives the results for production per worker for 2005. If value added is replaced by production, the ranking of the industries/activities greatly changes. In general, manufacturing activities obtain a higher position because of their more intensive use of intermediate inputs.

The homogenisation of workers with the product technology model increases the differences between activities both with respect to the non homogenised industries and the industry technology results. There are also more important effects on the ranking now. The manufacture of transport equipment (DM) comes in the third place if the activity is looked at (independent of the technique used), and only at the fourth place as an industry.

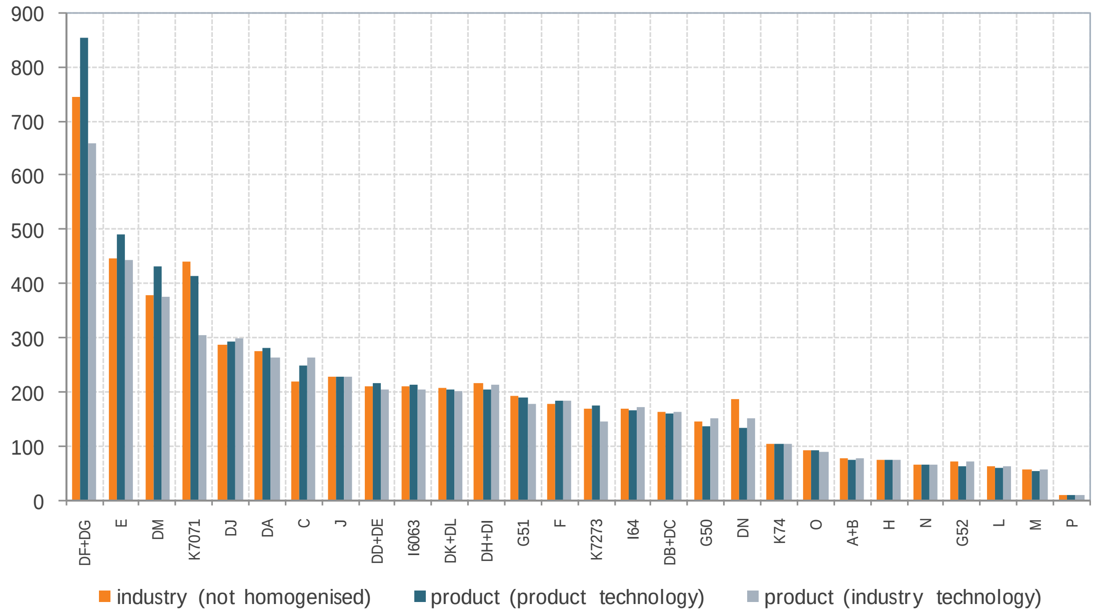
[42] Only real rents have been left in value added here. Imputed rents (rents received implicitly by house owners that dwell in their own house) have been removed.

Figure 7: Value added (*) per worker by industry and product in 2005 (thousands of Euro)



(*) Value added per product is obtained using the hybrid model, even in the case where employment is homogenised by industry technology

Figure 8: Production per worker by industry and product in 2005 (thousands of Euro)



6. Conclusion

Homogenising employment means generating employment data by product or activity starting from employment data by industry. This homogenisation is done using mathematical techniques starting from the Make table of the concerned year.

The techniques for homogenising employment data are the same as those for homogenising intermediate use. Commodity (or product) technology implies that the use of an employment category depends on the product, wherever it is produced. Industry technology implies that the use of an employment category is the same for all products produced in an industry. Because of this difference in underlying assumptions, the commodity technology model is preferred over the industry technology model. Other arguments in favour of the product technology include its greater robustness in the case of errors in the data (like firms or local KAU's that are placed in the wrong industry).

In some cases both commodity and industry technology yield biased results. One of these is the existence of employment categories, like self-employed administrators (providing management services) and temporary workers (providing interim services) that are used only for one specific activity. These categories of workers are better withdrawn from the homogenisation process.

In practice the commodity technology model is often replaced by a hybrid technology model, in which its hypothesis is loosened for a few industries. This was also the case for the homogenisation of Belgian employment data performed here for the years 2000 and 2005. The exercise was performed at the level of 130 input-output industries, but in the paper only results at the level of 28 aggregated activities are presented.

The results for employment by activity of the product and industry technology model were almost as different from each other as they were different from the original employment by industry. Both in 2000 and 2005, the most important differences between the two models are found in retail and wholesale trade. The industry technology model does not recognise that retail firms with important secondary activities tend to be large firms that work with a lower employment coefficient. As a result, too much workers are withdrawn from the retail activity and allocated to wholesale.

Using the hybrid model, it was possible to homogenise detailed employment data. First workers were detailed by gender and for each gender by education level. In a second step a distinction between employees and self-employed workers was introduced. Self-employed and employees are best considered as substitutes. We gave two examples of this: public firms never use self-employed workers even when performing market activities. Similarly, large firms use less self-employed and more employees to perform the same activities as small firms.

Therefore the assumption of commodity technology is more valid at the all workers level than for employees and self-employed separately. When providing homogenised series for self-employed and employees it is better to respect the results obtained for all workers. The results for employees can be obtained by taking the difference between the (corrected) homogenised series for all workers and that for self-employed workers. This method yields plausible employment figures and plausible wages per head for employees.

When compared to their non homogenised industry some activities “gain” workers, other “lose” workers. The activities that “gain” most workers are wholesale trade, computer & related activities and R&D, Machinery, Electrical & equipment and other community, social and personal services. The activities that “lose” most workers are Retail trade and Public administration. This means that, in 2000 and 2005, the latter industries engaged workers for performing secondary activities.

Both the product and the industry technology model largely respect the ranking of industries with respect to the use of high skilled labour and wage costs and value added per head. While leaving the ranking unchanged, the product technology model tends to increase the differences between activities, while the industry technology model tends to reduce them.

Thus activities that employ many (less) high schooled workers or more (less) female workers, do even more (less) so after being homogenised by the product technology model. A similar result is obtained for the ratio of value added per worker. The activities with the highest value added per worker (e.g. Electrical energy, gas steam and water; Real estate and rental services and Refineries, pharmaceutical & chemicals) have an even higher ratio once value added and workers have been homogenised using the product technology model.

The paper shows the gender and education level of the workers as well as the ratios of wage costs per employee and value added and production per worker for 28 activities. This comparison for 2000 and 2005 is in itself unique and interesting. One of the results is the striking difference between Wholesale trade and Retail trade. The first activity uses more highly or medium highly schooled workers, bears higher wage costs per employee and realises a much higher value added per worker than Retail trade. For all these criteria Belgian wholesale trade is more similar to manufacturing activities than to retail trade.

7. References

Almon, C. (2000), “Product-to-Product Tables via Product-Technology with No Negative Flows”, Economic Systems Research, 12, pp. 27-43.

Avonds, L, Deguel, V., Gilot, A., Hambye, C., Van den Cruyce, B. , Wera, J. (2003) “Méthodologie de la construction de l’IO95“, note Bureau Fédéral du Plan, sd/AG1667-9100, p 173.

Avonds, L (2005) “Belgian Input-output tables: state of the Art”, paper presented at the 15th IO conference in Beijing.

Avonds, L (2007), “The input-outputframework and modelling assumptions: considered from the point of view of the economic circuit”, paper presented at the 13th International Input-output Conference in Istanbul. p 45.

Bresseleers, V., Hendrickx, K., Hertveldt, B., Van den Cruyce, B., Wera, J. (2007) “Kwalitatieve werkgelegenheidsdata voor België, een SAM-aanpak voor de periode 1999-2005”, Federaal Planbureau, Working Paper 2-07, Brussels.

Eurostat (2008), “Transformation of supply and use tables to symmetric input-output tables”, in Eurostat Manual of Supply, Use and Input-output tables, Eurostat Methodologies and Working Papers, Chapter 11, pp 293-369.

Federaal Planbureau (2010), “Input-outputtabellen van België voor 2005”, ed. Henri Bogaert, Brussels, p 41.

Hendrickx, K., Hertveldt, B, Lopez-Novella M., Van den Cruyce, B. (2007) “Bijdrage aan IGVM loonkloofrapport 2008”, nota FPB, ADDG/6801/DSSD 1920.

Koller, W. (2006), “Commodity-by commodity Input-outputMatrices: Extensions and Experiences from an Application to Austria”, Industriewissenschaftliches Institut, Austria, p 24.

Konijn, P. (2002) “Transformation of Supply and Use tables to symmetric input-output tables” in: Eurostat: ESA 95 Input-outputManual-Compilation and Analysis (Luxemburg), pp 223-242.

Miller, R.E. & Blair, P.D. (1985), “Input-outputanalysis: foundations and extensions”, Prentice – Hall, Inc., Englewood Cliffs, New Jersey.

OECD (2005), “Working Party on Indicators for the Information Society, Guide to Measuring the Information Society”, DSTI/ICCP/IIS(2005)6/FINAL, November.

Schaffer, A. (2007) “Women’s and Men’s Contributions to Satisfying Consumers’ Needs: A Combined Time Use and Input-outputAnalysis”, *Economic Systems Research*, 19, no. 1, pp 23-36.

Ten Raa, T., Rueda-Cantuche (2007), “stochastic analysis of input-outputmultipliers on the basis of use and make tables”, *Review of Income and Wealth,* 53, nr 2, pp 318-334.

United Nations (1999) "handbook of Input-output table, compilation and analysis", Series F, No 74 (New York, department of Economic and Social Affairs).

Van den Cruyce, B., Wera, J. (2007), "Qualitative Employment Multipliers for Belgium, Results for 2000 and 2002", Working Paper 15-07, Federal Planning Bureau.

8. Appendix

Table 1 List of 28 industries or products (*)

Symbol	Products or industries	Nace 2003/cpa codes	# of IO 2005-branches
A+B	(Products of) agriculture, hunting, forestry & fishing	01-05	3
C	(Products from) mining and quarrying	10-14	3
D	Manufacturing (subtotal)	(15-37)	(59)
DA	Food products, beverages & tobacco	15-16	13
DB+DC	Textiles, leather & their products	17-19	4
DD+DE	Wood, paper & printing services	20-22	4
DF+DG	Coke, refined petroleum products & nuclear fuel; chemicals, chemical products & pharmaceuticals	23-24	9
DH+DI	Rubber & plastic products; other non metallic mineral products	25-26	6
DJ	Basic metals & fabricated metal products	27-28	5
DK+DL	Machinery & equipment n.e.c.; Electrical & optical equipment	29-33	9
DM	Transport equipment	34-35	6
DN	Other manufactured goods	36-37	3
E	Electrical energy, gas, steam & water	40-41	3
F	Construction activities	45	5
G50	Trade, maintenance & repair of motor vehicles & motorcycles, retail trade of automotive fuel	50	2
G51	Wholesale trade and commission trade services	51	2
G52	Retail trade & repair services	52	1
H	Hotel & restaurant services	55	2
I60-63	Transport services	60-63	10
I64	Postal and Communication services	64	2
J	Financial intermediation services	65-67	3
K7071	Real estate and rental services	70-71	4
K7273	Computer and related activities; Research and development	72-73	3
K74 (**)	Other business services	74	6
L	Public administration & defense services, compulsory social security	75	3
M	Education services	80	3
N	Health and social work services	85	4
O	Other community, social and personal services	90-93	12
P	Private households with employed persons	95	1
A-P	Total	01-95	131

(*) The cpa-2003 product classification corresponds fully to the Nace rev.1 industry classification in its first 4 digits. Because the 28 activities in this paper are always defined by a 2-digit code, the symbols used in the first column of table 1 will be used to indicate industries as well as products (or activities).

(**) The workers in the Other business services (Nace 74) include company administrators and temporary workers (detailed in table 4).

Table 2 Employment by gender and education level in 28 industries before homogenisation in 2005 (1000 workers)

28 Industries	Women						Men						Women	Men	Total
	Primary	Lower second.	Higher second.	Tertiary Short	Tertiary Long	Academic	Primary	Lower second.	Higher second.	Tertiary Short	Tertiary Long	Academic			
A+B	5.2	6.8	9.8	2.7	0.2	0.5	12.1	17.3	24.7	3.2	0.6	1.1	25.1	59.0	84.1
C	0.0	0.0	0.1	0.1	0.0	0.0	0.5	0.7	1.3	0.2	0.1	0.2	0.3	2.9	3.2
DA	4.4	7.9	15.2	4.9	0.7	1.9	9.2	14.9	28.4	5.0	1.3	3.3	35.0	62.0	97.0
DB+DC	3.4	5.7	8.1	2.1	0.3	0.7	4.5	6.3	8.7	1.7	0.4	0.9	20.2	22.5	42.7
DD+DE	1.2	2.2	6.5	3.9	0.7	2.2	4.5	9.7	21.0	4.7	1.3	3.1	16.7	44.2	60.9
DF+DG	1.0	2.1	6.1	5.9	1.2	4.0	3.0	7.8	22.6	9.4	3.2	9.5	20.3	55.4	75.7
DH+DI	0.8	1.6	3.9	2.0	0.3	0.7	6.6	11.8	21.6	3.9	1.1	2.7	9.3	47.6	56.9
DJ	0.8	1.7	4.1	2.2	0.3	0.8	10.3	25.4	45.2	6.4	1.7	4.4	9.8	93.3	103.2
DK+DL	1.7	3.2	7.8	2.8	0.5	1.6	4.4	13.2	30.8	8.7	2.7	7.6	17.7	67.5	85.2
DM	0.6	1.3	3.1	0.8	0.2	0.5	5.1	13.8	24.2	3.4	0.9	2.5	6.4	50.0	56.3
DN	0.9	1.4	2.9	0.9	0.1	0.2	3.0	6.3	9.9	1.4	0.4	0.9	6.4	21.8	28.2
E	0.1	0.3	2.1	1.3	0.2	0.8	0.8	2.8	8.8	3.8	0.9	2.3	4.8	19.4	24.1
F	1.1	2.3	7.7	3.4	0.5	1.3	39.4	65.5	99.3	10.2	2.5	5.7	16.2	222.6	238.8
G50	1.3	2.7	7.6	2.9	0.3	0.7	6.0	14.5	31.4	5.2	1.0	2.0	15.6	60.1	75.6
G51	3.9	9.8	32.3	19.0	2.8	7.4	11.7	26.3	62.0	23.8	6.1	13.6	75.2	143.5	218.8
G52	14.6	39.9	97.0	19.1	3.2	8.8	12.1	26.8	57.8	11.9	3.3	7.1	182.6	119.0	301.6
H	14.1	20.7	33.8	5.4	0.6	1.4	10.2	18.5	37.5	4.9	0.8	1.6	76.1	73.5	149.6
I60-63	2.3	5.3	20.7	10.8	1.4	4.5	22.9	44.9	72.5	13.4	2.9	8.0	45.0	164.6	209.6
I64	2.3	4.9	12.2	2.8	0.5	1.7	6.1	15.6	23.9	5.2	1.5	4.7	24.4	56.9	81.3
J	1.4	4.5	25.0	21.6	3.8	11.1	1.1	3.8	20.0	22.0	7.0	17.7	67.4	71.5	138.9
K7071	2.0	2.5	5.9	3.5	0.5	1.4	1.8	3.6	7.4	3.0	0.9	2.3	15.8	19.1	34.9
K7273	0.2	0.5	3.1	5.1	1.3	5.4	0.3	1.1	6.5	12.1	4.4	13.6	15.6	38.0	53.6
K74	24.3	37.3	85.9	45.9	9.9	41.3	28.0	50.7	128.4	53.6	21.3	62.7	244.6	344.7	589.2
L	14.0	31.7	82.8	35.0	5.5	23.3	15.3	45.7	97.1	28.0	7.3	33.2	192.1	226.7	418.8
M	6.4	13.4	29.9	128.8	12.0	39.5	1.5	5.0	14.0	48.3	9.2	32.0	230.0	110.0	340.0
N	21.4	41.5	123.2	114.2	12.5	38.1	9.8	11.8	21.6	25.1	7.5	37.6	350.8	113.4	464.2
O	7.5	15.6	43.2	13.0	2.5	8.5	7.0	12.8	25.5	10.0	3.3	9.5	90.2	68.1	158.2
P	13.8	20.3	27.5	2.0	0.2	0.5	0.8	1.0	0.8	0.1	0.0	0.0	64.4	2.7	67.1
Total	150.5	287.5	707.4	461.8	62.2	208.6	237.8	477.4	952.9	328.3	93.7	289.8	1878.0	2379.9	4257.9

Table 3: The Belgian Make table for 2005, a selection of 28 products (rows) and 18 industries (columns) (billion Euro)

Products	A+B	C	D	E	F	G50	G51	G52	H	I6063	I64	J	K7071	K7273	K74	L+M+N	O+P	Total
A+B	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5
C	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
DA	0.1	0.0	25.7	0.0	0.0	0.0	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	27.9
DB+DC	0.0	0.0	6.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6
DD+DE	0.0	0.0	12.3	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	13.0
DF+DG	0.0	0.0	52.2	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	54.1
DH+DI	0.0	0.0	11.3	0.0	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1
DJ	0.0	0.0	28.1	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	28.8
DK+DL	0.0	0.0	18.6	0.0	0.4	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	20.2
DM	0.0	0.0	20.5	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8
DN	0.0	0.0	2.9	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
E	0.0	0.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	10.3
F	0.0	0.0	0.3	0.3	39.8	0.0	0.1	0.0	0.0	0.4	0.0	0.0	1.2	0.0	0.0	0.0	0.0	42.1
G50	0.0	0.0	0.3	0.0	0.0	9.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6
G51	0.0	0.0	6.9	0.0	0.5	1.4	35.0	3.1	0.0	0.2	0.0	0.0	0.0	0.1	0.7	0.0	0.0	48.0
G52	0.0	0.0	0.0	0.0	0.0	0.1	0.2	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1
H	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	11.6
I6063	0.0	0.0	0.5	0.0	0.3	0.2	0.8	0.3	0.0	42.5	0.2	0.0	0.0	0.0	0.0	0.1	0.2	45.0
I64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	13.1	0.0	0.0	0.0	0.0	0.0	0.0	13.2
J	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	30.5	0.2	0.0	0.0	0.0	0.0	30.7
K7071	0.0	0.0	0.0	0.0	0.6	0.1	0.2	0.2	0.0	0.4	0.1	0.7	37.8	0.0	0.3	0.3	0.0	40.7
K7273	0.0	0.0	1.6	0.2	0.0	0.0	0.4	0.2	0.0	0.1	0.2	0.4	0.0	8.8	0.9	1.8	0.1	14.8
K74	0.0	0.0	1.0	0.1	0.3	0.1	0.5	0.1	0.0	0.2	0.0	0.1	0.3	0.1	58.0	0.4	0.2	61.6
L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.1	0.0	24.1
M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	18.3	0.0	18.4
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7	0.0	30.7
O	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	14.7	16.7
P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.	0.6	0.6
Total	6.5	0.7	189.4	10.8	42.7	11.1	42.5	21.9	11.3	44.3	13.7	31.8	39.7	9.1	61.3	77.5	15.5	629.8

Table 4 Company administrators & other self-employed and (not assigned) temporary & other employees in 2000 and 2005 (**)

Worker types	Women						Men						Women	Men	Total
	Primary	Lower second.	Higher second.	Tertiary Short	Tertiary Long	Academic	Primary	Lower second.	Higher second.	Tertiary Short	Tertiary Long	Academic			
2005 (in 1000 workers)															
Self-employed	19.9	37.4	92.0	43.8	10.0	45.8	40.5	75.0	172.9	53.0	23.0	81.0	249.0	445.5	694.5
Company administrators	2.3	5.9	19.5	9.6	1.9	12.0	6.8	15.1	58.7	19.5	8.4	20.5	51.1	129.0	180.2
Other self-employed(*)	17.6	31.6	72.5	34.2	8.1	33.8	33.6	60.0	114.2	33.6	14.6	60.5	197.9	316.5	514.3
Employees	130.7	250.1	615.4	417.9	52.2	162.8	197.3	402.3	780.0	275.3	70.6	208.8	1629.0	1934.4	3563.4
Temporary workers	3.0	7.0	17.9	6.3	1.0	2.8	8.7	15.7	26.7	5.1	1.0	2.1	37.9	59.3	97.2
Other employees	127.7	243.1	597.5	411.7	51.2	160.0	188.6	386.6	753.4	270.2	69.7	206.7	1591.1	1875.1	3466.2
2000 (in 1000 workers)															
Self-employed	28.5	45.3	90.2	39.8	9.3	37.9	54.4	89.3	159.5	47.8	20.4	79.4	251.0	450.8	701.8
Company administrators	2.8	5.4	14.1	7.2	1.8	7.1	7.6	15.7	37.6	13.6	5.6	18.5	38.4	98.7	137.1
Other self-employed(*)	25.7	40.0	76.1	32.6	7.5	30.7	46.8	73.6	121.9	34.1	14.7	60.9	212.6	352.1	564.7
Employees	151.1	272.0	538.3	345.7	43.6	137.0	245.6	470.4	696.8	239.8	65.0	201.7	1487.8	1919.3	3407.1
Temporary workers	5.1	8.6	14.7	5.9	1.2	3.6	12.4	15.5	21.4	6.0	1.2	2.9	39.2	59.5	98.7
Other employees	146.0	263.4	523.6	339.8	42.4	133.4	233.2	454.9	675.4	233.8	63.8	198.8	1448.6	1859.8	3308.4

(*) The other self-employed include all self-employed and their assistants that are not the manager of a company or have no mandate in a company board (a company is a firm with a corporate personality).

(**) The totals for company administrators and temporary workers by gender are estimates by the Federal Planning Bureau based on RSVZ/INASTI and RSZ/ONSS data. The distribution over education levels is estimated at the Federal Planning Bureau using Labour Force Survey data.

Table 5 Formation level[1] by gender and total employment in 2000 and 2005 in 28 non-homogenised industries (% and 1000 persons)

Industry	Formation level female workers (%)						Formation level male workers (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	2	48	50	3	58	40	2	50	47	3	29	30	88.4	84.1
C	18	70	13	13	72	15	51	41	7	43	49	7	8	9	3.7	3.2
DA	41	52	6	35	57	7	46	47	7	39	54	7	35	36	98.4	97.0
DB+DC	54	43	3	45	50	5	55	40	6	48	47	6	50	47	57.1	42.7
DD+DE	26	59	14	20	62	18	39	52	9	32	58	10	27	27	67.3	60.9
DF+DG	20	57	22	15	59	26	26	53	21	19	58	23	24	27	78.5	75.7
DH+DI	33	58	9	26	63	11	47	46	7	39	54	8	16	16	59.7	56.9
DJ	30	61	9	25	64	11	46	48	6	38	55	7	9	10	105.9	103.2
DK+DL	35	55	10	28	60	12	32	53	15	26	59	15	21	21	99.3	85.2
DM	36	56	8	30	60	10	46	48	6	38	55	7	10	11	64.0	56.3
DN	43	53	4	36	59	5	51	44	5	42	52	6	22	23	31.7	28.2
E	16	67	17	9	69	21	25	59	16	18	65	17	15	20	27.1	24.1
F	27	65	9	21	68	11	56	41	3	47	49	4	7	7	244.2	238.8
G50	34	61	5	26	68	7	42	53	4	34	61	5	21	21	75.1	75.6
G51	24	64	13	18	68	14	31	55	14	26	60	14	34	34	208.6	218.8
G52	36	58	6	30	64	7	38	53	9	33	59	9	60	61	294.8	301.6
H	51	47	2	46	52	3	44	53	3	39	58	3	52	51	145.8	149.6
I6063	20	69	12	17	70	13	49	45	5	41	52	7	21	21	211.4	209.6
I64	35	58	8	30	62	9	47	45	8	38	51	11	30	30	82.6	81.3
J	13	67	20	9	69	22	9	58	33	7	59	35	46	49	145.0	138.9
K7071	38	52	10	29	59	12	32	51	17	29	54	17	45	45	30.0	34.9
K7273	6	53	41	4	52	43	4	49	47	4	49	47	30	29	46.6	53.6
K74	31	50	19	25	54	21	28	47	25	23	53	24	41	42	521.7	589.2
L	30	57	12	24	61	15	33	49	17	27	55	18	44	46	392.3	418.8
M	11	67	22	9	69	22	7	54	39	6	57	37	66	68	312.0	340.0
N	21	64	15	18	68	14	20	37	42	19	41	40	74	76	403.2	464.2
O	28	61	11	26	62	12	29	52	19	29	52	19	57	57	149.9	158.2
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	29	58	13	23	62	14	36	48	15	30	54	16	42	44	4108.8	4257.9

1 Formation levels have been aggregated into: low (=primary and lower secondary education), medium (higher secondary and higher short type) and high (higher education long type or academic)

Table 6 Formation level[2] by gender and total employment in 1999 and 2009 in 28 non-homogenised industries (% and 1000 persons)

Industry	Formation level female workers (%)						Formation level male workers (%)						Women (%)		Employment (x 1000)	
	1999			2009			1999			2009			1999	2009	1999	2009
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	60	38	1	42	54	4	60	38	2	44	53	3	30	29	90.5	77.0
C	21	68	12	11	72	16	54	39	7	37	55	8	8	8	3.8	3.0
DA	43	51	6	32	60	8	48	45	7	34	59	8	35	37	98.9	94.2
DB+DC	56	41	3	40	54	6	57	38	6	42	52	6	51	48	59.1	33.1
DD+DE	28	58	14	17	63	21	41	50	9	27	62	10	27	28	66.1	56.6
DF+DG	23	56	21	13	59	29	28	51	21	16	60	24	24	28	76.4	73.8
DH+DI	35	57	8	22	65	13	49	44	7	33	58	8	16	16	59.9	53.5
DJ	32	60	9	21	66	12	49	45	6	32	61	7	9	10	104.6	99.6
DK+DL	38	53	9	24	62	14	34	51	14	22	63	15	21	20	97.5	84.5
DM	38	54	8	25	63	13	49	45	6	32	60	7	10	11	61.0	44.8
DN	46	51	4	31	63	6	53	42	5	37	57	6	22	22	32.0	24.9
E	18	66	16	6	69	25	27	57	16	14	68	18	15	23	27.5	27.6
F	30	62	8	18	69	13	58	39	3	40	56	4	7	7	239.2	262.1
G50	38	58	5	22	71	7	44	52	4	29	66	6	21	21	73.7	78.3
G51	26	62	12	16	70	14	33	54	14	22	64	14	33	35	204.2	227.4
G52	39	56	6	26	67	7	39	52	9	28	63	9	59	60	295.6	301.0
H	52	46	2	42	55	3	45	52	3	36	60	3	52	50	148.4	147.2
I6063	21	68	11	16	71	14	52	43	5	35	57	8	21	23	207.2	220.3
I64	38	56	6	27	64	9	51	42	7	33	54	13	29	30	80.0	72.8
J	16	65	18	7	69	23	10	57	33	5	58	36	46	51	143.7	131.5
K7071	40	51	9	18	67	15	33	51	17	25	56	19	47	43	29.2	34.8
K7273	7	53	41	5	54	42	5	48	47	3	49	48	30	30	40.6	65.3
K74	33	48	18	24	56	20	29	46	25	19	57	24	41	44	491.1	697.8
L	33	56	11	20	64	16	36	47	16	23	58	18	43	47	382.5	431.8
M	13	66	21	7	70	23	8	53	39	6	59	36	65	69	317.1	357.9
N	23	63	14	16	70	14	21	36	43	18	44	39	74	77	388.0	513.1
O	29	60	11	26	62	12	29	52	19	30	51	19	57	58	148.6	173.0
P	59	40	1	52	47	1	69	29	2	66	32	2	96	96	61.1	49.3
Total	31	57	12	20	64	15	38	47	15	26	58	17	42	45	4027.5	4438.0

2 The three Formation levels are low (=primary and lower secondary education), medium (=higher secondary and higher short type) and high (=higher education long type or academic)

Table 7 Formation level[3] by gender and employment in 2000 and 2005 in 28 industries homogenised using commodity technology, without corrections (% and 1000 persons)

Products	Formation level female workers (%)						Formation level male workers (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	2	48	50	3	58	40	2	50	47	3	29	30	91.0	84.8
C	17	70	13	12	73	15	51	41	8	43	49	7	8	7	5.5	4.6
DA	43	52	6	36	57	7	47	46	7	40	53	7	35	36	95.4	99.5
DB+DC	55	42	3	46	49	4	58	37	5	50	45	5	53	48	53.4	41.2
DD+DE	27	59	14	20	62	18	40	52	9	32	58	9	27	27	65.8	60.3
DF+DG	18	57	25	15	58	27	24	53	23	18	59	23	23	25	66.9	63.3
DH+DI	35	57	7	27	63	10	47	46	6	39	54	7	16	16	64.1	59.1
DJ	30	62	8	26	65	9	48	47	5	39	55	6	8	9	104.3	98.0
DK+DL	37	55	9	30	59	11	32	53	15	27	59	15	20	19	110.1	98.4
DM	36	55	9	28	60	12	46	48	6	38	55	7	9	9	58.8	48.1
DN	45	52	3	39	58	3	52	43	5	44	51	5	21	22	31.5	23.7
E	15	68	17	9	71	19	23	60	17	17	68	15	15	20	24.5	21.0
F	26	65	8	22	69	9	56	40	3	48	49	3	6	6	253.7	229.6
G50	35	60	5	27	68	5	42	53	4	35	61	4	22	18	84.3	69.0
G51	22	65	13	17	69	14	30	56	14	26	61	14	34	35	226.6	251.5
G52	37	58	5	30	63	6	40	53	6	34	59	8	62	63	268.3	285.8
H	51	47	2	46	52	3	44	53	3	39	58	3	52	51	154.1	153.8
I6063	18	70	12	16	71	13	50	45	5	42	52	6	20	21	205.4	211.5
I64	36	57	7	30	61	8	49	44	7	39	51	10	30	30	83.4	79.6
J	13	68	20	9	69	22	9	58	33	7	59	34	47	48	142.7	134.2
K7071	37	53	10	28	61	11	3	67	30	27	56	17	62	44	25.9	39.6
K7273	1	51	48	3	52	45	1	49	50	3	48	49	27	31	68.8	84.7
K74	32	49	19	26	54	21	28	47	25	23	53	25	42	42	511.6	591.2
L	31	57	11	24	61	14	34	49	17	27	55	18	43	46	362.8	392.3
M	11	67	22	9	70	22	7	54	40	6	58	37	66	68	315.5	329.1
N	21	64	15	18	68	14	21	38	42	19	41	40	74	76	407.6	466.1
O	26	62	12	24	62	13	29	52	19	28	52	19	56	56	162.4	171.1
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	29	58	13	23	62	14	36	48	15	30	54	16	42	44	4108.8	4257.9

[3] Formation levels are low (=primary and lower secondary education), medium (higher secondary and higher short type) and high (higher education long type or academic)

Table 8 Formation level[4] by gender and employment in 2000 and 2005 in 28 industries homogenised using commodity technology, with corrections (% and 1000 persons)

Products	Formation level female workers (%)						Formation level male workers (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	2	48	50	3	58	40	2	50	47	3	29	30	91.0	84.8
C	17	70	13	12	73	15	51	41	8	43	49	7	8	7	5.5	4.6
DA	43	52	6	36	57	7	47	46	7	40	53	7	35	36	95.4	99.5
DB+DC	55	42	3	46	49	4	58	37	5	50	45	5	53	48	53.4	41.2
DD+DE	27	59	14	20	62	18	40	52	9	32	58	9	27	27	65.8	60.3
DF+DG	18	57	25	15	58	27	24	53	23	18	59	23	23	25	66.9	63.3
DH+DI	35	57	7	27	63	10	47	46	6	39	54	7	16	16	64.1	59.1
DJ	30	62	8	26	65	9	48	47	5	39	55	6	8	9	104.3	98.0
DK+DL	37	54	9	30	59	11	32	53	14	27	59	15	21	19	110.1	98.4
DM	36	55	9	28	60	12	46	48	6	38	55	7	9	9	58.8	48.1
DN	45	52	3	39	58	3	52	43	5	44	51	5	21	22	31.5	23.7
E	15	68	17	9	71	19	23	60	17	17	68	15	15	20	24.5	21.0
F	34	58	7	22	69	9	56	41	3	48	49	3	7	6	253.7	229.6
G50	35	60	5	27	68	5	42	53	4	35	61	4	22	18	84.3	69.0
G51	22	65	13	17	69	14	30	56	14	26	61	14	34	35	226.6	251.5
G52	37	58	5	30	63	6	40	53	6	34	59	8	62	63	268.3	285.8
H	51	47	2	46	52	3	44	53	3	39	58	3	52	51	154.1	153.8
I6063	18	70	12	16	71	13	50	45	5	42	52	6	20	21	205.4	211.5
I64	36	57	7	30	61	8	49	44	7	39	51	10	30	30	83.4	79.6
J	13	68	20	9	69	22	9	58	33	7	59	34	47	48	142.7	134.2
K7071	28	61	11	28	61	11	21	56	23	27	56	17	54	44	25.6	39.6
K7273	2	51	47	3	52	45	2	49	50	3	48	49	27	31	69.1	84.7
K74	32	49	19	26	54	21	28	47	25	23	53	25	42	42	511.6	591.2
L	31	57	11	24	61	14	34	49	17	27	55	18	43	46	362.8	392.3
M	11	67	22	9	70	22	7	54	40	6	58	37	66	68	315.5	329.1
N	21	64	15	18	68	14	21	38	42	19	41	40	74	76	407.6	466.1
O	26	62	12	24	62	13	29	52	19	28	52	19	56	56	162.4	171.1
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	28.6	58.3	13.1	23.3	62.3	14.4	36.3	48.3	15.5	30.0	53.8	16.1	42.3	44.1	4108.8	4257.9

[4] Formation levels are low (=primary and lower secondary education), medium (higher secondary and higher short type) and high (higher education long type or academic)

Table 9 Formation level[5] by gender and employment in 2000 and 2005 in 28 industries homogenised using industry technology (% and 1000 persons)

Products	Formation level female workers (%)						Formation level male workers (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	56	42	2	47	50	3	58	40	2	50	47	3	30	30	90.3	83.4
C	23	64	13	15	70	15	46	44	9	42	50	8	16	10	5.5	4.3
DA	40	53	7	34	58	8	45	47	8	38	54	8	35	36	102.4	105.6
DB+DC	53	44	4	45	51	5	53	41	6	47	47	6	50	46	54.5	40.4
DD+DE	27	59	14	21	62	17	39	51	10	32	58	10	28	29	67.5	63.2
DF+DG	22	57	20	19	58	23	28	53	20	22	57	21	25	28	82.6	82.0
DH+DI	33	58	10	26	63	12	46	46	8	39	53	8	16	17	62.4	57.0
DJ	31	59	10	26	63	11	46	48	7	38	55	7	11	11	104.2	96.0
DK+DL	34	56	10	27	61	12	34	52	14	28	58	14	21	20	115.2	99.7
DM	35	56	8	30	60	10	46	48	6	38	55	7	11	12	64.9	55.4
DN	42	53	5	35	60	6	50	45	6	41	53	6	23	22	29.7	20.8
E	16	67	17	11	68	21	25	59	17	18	64	17	15	21	25.3	23.2
F	29	62	9	21	68	11	55	41	4	47	49	4	8	7	250.6	227.7
G50	32	60	8	26	67	7	41	53	6	34	61	5	24	20	80.0	63.3
G51	29	61	10	23	66	12	33	54	13	28	59	13	39	37	254.4	267.9
G52	36	58	6	30	64	7	38	53	9	33	59	9	59	60	201.6	246.9
H	49	47	3	45	52	3	43	53	4	39	58	4	52	51	149.9	153.3
I6063	21	67	12	18	69	13	49	45	6	41	52	7	23	23	202.0	217.9
I64	34	58	8	29	62	9	46	45	9	38	51	11	29	30	80.6	76.3
J	13	67	20	9	69	22	10	57	32	7	59	34	46	48	143.5	135.2
K7071	34	55	11	27	60	13	33	51	16	31	54	15	43	42	49.3	53.5
K7273	20	55	25	11	61	28	14	49	36	9	51	40	38	42	74.4	101.4
K74	31	50	19	25	54	21	28	47	24	23	53	24	41	41	516.4	587.2
L	30	57	13	24	61	15	33	50	17	27	55	18	43	46	357.3	373.9
M	11	67	22	9	69	22	7	54	39	6	57	38	66	68	305.3	312.7
N	21	64	15	18	68	14	21	37	42	19	41	40	74	75	404.4	464.1
O	29	60	11	26	62	12	30	52	18	29	53	19	55	56	170.2	178.4
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	28.6	58.3	13.1	23.3	62.3	14.4	36.3	48.3	15.5	30.0	53.8	16.1	42	44.1	4108.8	4257.9

5 Formation levels are low (=primary and lower secondary education), medium (higher secondary and higher short type) and high (higher education long type or academic)

Table 10 Employment by output ratios for 28 industries or products (in workers per million euro of production)

Symbol	Products or industries	Non homogenised industries		Products, commodity technology		Products, industry technology	
		2000	2005	2000	2005	2000	2005
A+B	(Products of) agriculture, hunting, forestry & fishing	11.8	12.9	11.9	13.0	11.8	12.8
C	(Products from) mining and quarrying	4.7	4.5	4.8	4.0	4.9	3.8
DA	Food products, beverages & tobacco	3.8	3.6	3.7	3.6	4.0	3.8
DB+DC	Textiles, leather & their products	6.1	6.2	6.1	6.2	6.2	6.1
DD+DE	Wood, paper & printing services	5.0	4.7	5.0	4.6	5.1	4.9
DF+DG	Coke, refined petroleum products & nuclear fuel; chemicals, chemical products & pharmaceuticals	1.8	1.3	1.5	1.2	1.9	1.5
DH+DI	Rubber & plastic products; other non metallic mineral products	5.1	4.6	5.2	4.9	5.0	4.7
DJ	Basic metals & fabricated metal products	4.4	3.5	4.4	3.4	4.3	3.3
DK+DL	Machinery & equipment n.e.c.; Electrical & optical equipment	4.7	4.8	4.6	4.9	4.9	4.9
DM	Transport equipment	3.0	2.6	2.8	2.3	3.1	2.7
DN	Other manufactured goods	5.7	5.4	6.5	7.5	6.2	6.5
E	Electrical energy, gas, steam & water	2.7	2.2	2.6	2.0	2.7	2.3
F	Construction activities	6.8	5.6	6.8	5.5	6.7	5.4
G50	Trade, maintenance & repair of motor vehicles & motorcycles, retail trade of automotive fuel	8.3	6.8	8.7	7.2	8.2	6.6
G51	Wholesale trade and commission trade services	5.4	5.1	5.4	5.2	6.1	5.6
G52	Retail trade & repair services	15.2	13.8	19.8	15.8	14.9	13.6
H	Hotel & restaurant services	15.2	13.2	15.3	13.3	14.9	13.3
I60-63	Transport services	5.7	4.7	5.7	4.7	5.6	4.8
I64	Postal and Communication services	7.9	5.9	8.1	6.0	7.9	5.8
J	Financial intermediation services	5.4	4.4	5.5	4.4	5.6	4.4
K7071	Real estate and rental services(*)	2.9	0.9	2.2	1.0	4.2	1.3
K7273	Computer and related activities; Research and development	6.3	5.9	6.5	5.7	7.0	6.9
K74	Other business services	11.5	9.6	11.9	9.6	12.0	9.5
L	Public administration & defence services, compulsory social security	18.6	15.6	18.9	16.3	18.7	15.5
M	Education services	19.3	17.1	19.6	17.8	18.9	17.0
N	Health and social work services	17.0	15.1	17.2	15.2	17.0	15.1
O	Other community, social and personal services	12.8	10.6	12.5	10.7	13.1	11.1
P	Private households with employed persons	86.0	104.1	86.0	104.1	86.0	104.1
A-P	Total	7.9	6.8	7.9	6.8	7.9	6.8

(*) The output of real estate and rental services that have no employment input have been removed from output.

Table 11 Self-employed and their formation level& gender in 2000 and 2005 and in 28 not homogenised industries (% and 1000 persons)

Products	Formation level female self-employed (%)						Formation level male self-employed (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	1	48	49	2	59	39	2	51	46	3	29	31	64.7	57.6
C	39	52	9	31	62	7	43	48	8	39	51	9	11	21	0.1	0.1
DA	47	49	4	39	55	5	49	44	7	44	49	7	28	26	9.9	8.8
DB+DC	40	53	7	31	58	11	38	50	12	32	55	13	57	58	3.0	2.3
DD+DE	28	59	13	20	62	18	30	57	12	26	61	13	32	30	4.7	4.9
DF+DG	29	51	21	24	48	28	29	41	30	26	42	32	43	38	0.2	0.1
DH+DI	31	60	9	26	62	12	40	51	9	34	55	10	36	29	1.1	0.9
DJ	35	62	3	28	69	3	39	52	9	33	57	9	10	9	4.4	4.2
DK+DL	37	51	13	30	55	15	23	56	21	19	58	22	24	25	2.4	2.2
DM	39	56	5	33	58	9	34	52	14	30	55	15	23	9	0.3	0.2
DN	31	61	7	25	66	9	41	49	10	37	52	11	18	16	3.9	3.6
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
F	44	52	5	37	57	5	51	45	4	44	52	4	11	9	55.2	49.7
G50	43	55	2	36	62	2	43	55	2	38	59	3	31	28	18.6	14.6
G51	36	52	12	30	57	13	33	53	14	30	55	15	31	30	27.7	23.4
G52	37	55	8	30	60	9	39	52	9	34	56	10	45	45	99.1	78.4
H	53	44	3	47	50	3	44	52	4	41	55	4	48	47	48.8	43.9
I6063	46	50	5	41	53	5	47	45	8	37	54	9	25	24	10.8	8.3
I64	48	41	11	43	44	13	49	38	14	39	45	16	13	17	2.6	3.8
J	21	63	16	15	67	18	8	62	31	7	60	33	33	30	12.7	10.1
K7071	24	58	18	17	62	21	17	55	28	16	53	31	32	32	5.7	5.2
K7273	12	43	45	9	42	49	5	49	46	5	47	49	30	29	3.7	5.5
K74	17	51	32	13	52	35	19	48	34	14	54	31	29	30	201.3	244.3
L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
M	6	47	47	5	44	51	11	35	54	14	39	48	62	63	1.1	1.5
N	7	43	50	6	43	51	1	13	86	1	12	87	52	55	71.5	72.6
O	26	70	5	23	71	6	28	61	11	28	60	12	61	63	48.3	48.1
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total	29	52	19	23	55	22	32	46	22	26	51	23	36	36	701.8	694.5

Table 12 Self-employed and their formation level & gender in 2000 and 2005, product technology without corrections (% and 1000 persons (*)[6])

Products	Formation level female self-employed (%)						Formation level male self-employed (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	1	48	49	2	59	39	2	51	46	3	28	30	66.8	58.3
C	25	44	31	33	69	-2	37	46	17	45	49	6	10	14	0.1	0.1
DA	48	49	3	40	55	5	51	43	6	45	49	6	27	26	9.0	8.8
DB+DC	44	48	8	32	56	12	40	47	13	33	54	13	64	60	2.0	1.9
DD+DE	30	61	9	21	64	16	32	59	9	26	63	11	32	29	4.1	4.4
DF+DG	-36	-53	-11	-28	-55	-16	-31	-55	-14	-29	-53	-18	-28	-30	-1.0	-1.2
DH+DI	26	68	5	25	69	6	57	45	-2	40	59	1	56	34	0.5	0.5
DJ	33	70	-3	30	73	-3	38	53	8	34	58	8	7	8	4.0	4.2
DK+DL	41	50	9	31	55	14	14	59	27	15	61	24	23	21	1.8	1.9
DM	-39	-57	-4	-32	-61	-7	-43	-53	-4	-36	-57	-8	-20	-21	-0.6	-0.9
DN	31	63	7	24	68	8	41	48	10	38	52	11	17	15	4.5	3.4
E	-33	-49	-17	-7	-41	-52	-38	-48	-14	-13	-42	-45	-17	-23	-0.1	-0.6
F	44	52	4	40	58	1	51	45	4	45	52	3	11	8	57.4	48.8
G50	42	55	2	37	62	1	42	55	2	39	59	2	32	27	21.2	14.2
G51	37	52	11	31	57	12	32	54	13	30	56	14	31	30	30.1	27.1
G52	37	55	7	31	60	9	39	52	8	34	56	10	46	46	96.6	77.6
H	53	44	3	47	50	3	45	52	4	41	55	4	48	47	51.7	45.3
I6063	46	51	3	42	53	4	48	45	7	37	54	9	24	25	9.9	7.7
I64	-93	153	40	48	41	10	65	28	7	41	44	14	-4	16	1.6	3.5
J	21	63	15	15	67	18	8	62	30	7	60	33	33	30	12.9	10.3
K7071	22	59	19	19	66	15	8	57	35	17	55	28	37	32	6.6	5.1
K7273	-4	29	74	9	42	49	-4	48	57	4	47	49	22	28	4.0	7.4
K74	16	51	33	13	52	35	18	47	34	14	54	32	29	30	200.2	246.4
L	-9	-42	-48	-270	-86	256	-41	-45	-14	-2	-33	-65	-59	11	-2.9	-0.4
M	-15	49	66	-6	43	63	-29	15	113	-3	27	76	72	70	0.9	1.4
N	7	43	50	6	43	51	1	13	86	1	12	87	53	55	72.9	72.5
O	25	70	5	23	72	6	28	62	10	28	61	12	62	64	47.6	46.8
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total	29	52	19	23	55	22	32	46	22	26	51	23	36	36	701.8	694.5

(*) Percentages have been multiplied with the sign of the employment total for a homogenised industry. This way they continue to reflect underlying negative numbers.

Table 13 Self-employed and their formation level and gender in 2000 and 2005, industry technology (% and 1000 persons)

Products	Formation level female self-employed (%)						Formation level male self-employed (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	1	48	49	2	59	39	2	51	46	3	29	31	64.7	56.8
C	34	52	13	36	58	7	34	50	16	43	50	6	29	17	0.3	0.2
DA	45	50	5	38	55	7	47	45	7	42	49	9	30	28	11.4	10.5
DB+DC	39	53	8	31	58	11	36	49	15	31	54	14	54	55	3.3	2.2
DD+DE	27	58	15	21	61	18	31	56	13	26	60	14	32	30	5.2	5.2
DF+DG	31	50	19	18	49	33	29	48	23	19	43	38	33	33	1.4	1.5
DH+DI	32	57	11	27	60	14	40	49	10	34	54	12	27	24	2.1	1.7
DJ	32	55	14	28	64	8	38	50	12	34	56	10	15	12	5.5	4.4
DK+DL	32	51	17	27	55	19	29	51	20	26	54	20	22	22	5.0	4.4
DM	39	56	6	27	58	15	37	53	11	31	54	15	24	19	0.7	0.5
DN	32	60	7	26	65	9	41	49	10	37	52	11	19	17	3.7	2.5
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.1
F	42	52	6	37	57	6	50	46	4	44	52	4	11	9	53.9	45.9
G50	40	54	6	36	62	2	40	54	6	38	59	3	32	28	20.1	11.8
G51	36	54	10	30	58	12	35	52	12	32	55	14	37	34	44.1	35.8
G52	37	55	8	30	60	9	39	52	9	34	56	10	45	45	67.3	64.1
H	53	44	3	47	50	3	44	52	4	41	55	4	48	47	49.1	44.0
I6063	44	51	6	39	55	6	46	46	8	37	54	9	27	26	12.2	10.5
I64	35	42	23	42	43	14	42	38	20	38	45	17	15	18	3.0	3.6
J	21	63	16	15	67	18	9	61	30	8	59	33	33	30	12.8	10.2
K7071	29	55	15	20	60	20	25	53	23	22	52	25	36	30	8.2	7.1
K7273	25	49	26	12	45	42	19	47	34	9	46	45	36	32	10.0	8.1
K74	18	51	31	13	53	34	19	48	33	15	55	30	29	30	196.8	241.7
L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
M	6	47	47	5	44	51	11	37	53	13	39	48	61	61	1.2	1.6
N	7	43	50	6	43	51	1	13	86	1	12	87	52	55	71.2	72.3
O	26	69	5	23	71	6	28	60	12	28	60	12	60	63	48.6	47.8
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total	29	52	19	23	55	22	32	46	22	26	51	23	36	36	701.8	694.5

Table 14 Self-employed and their formation level and gender in 2000 and 2005, product technology plus corrections, final result (% and 1000 persons)

Products	Formation level female self-employed (%)						Formation level male self-employed (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	41	1	49	49	2	59	39	2	51	46	3	28	31	66.1	57.7
C	25	44	31	29	59	12	37	46	17	45	49	6	10	15	0.1	0.1
DA	47	49	4	40	55	5	50	44	6	45	49	7	28	26	10.1	9.9
DB+DC	44	48	8	32	56	12	39	48	14	33	54	13	61	60	2.1	1.9
DD+DE	30	61	9	20	62	17	32	59	9	26	62	13	31	30	4.0	4.9
DF+DG	23	48	29	15	45	40	23	28	48	23	39	37	51	33	0.1	0.1
DH+DI	28	64	8	26	64	10	42	50	9	36	56	8	38	30	0.8	0.7
DJ	32	67	1	28	70	2	38	53	8	34	58	9	8	8	4.1	4.4
DK+DL	38	49	12	30	54	16	19	57	24	17	59	23	24	23	2.5	2.7
DM	40	56	3	34	55	10	34	50	16	29	54	17	26	8	0.2	0.2
DN	31	63	7	24	67	8	41	48	10	38	52	11	17	15	4.4	3.3
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
F	44	52	4	38	57	5	51	45	4	44	52	4	10	9	56.9	48.4
G50	42	55	2	37	62	1	42	55	3	39	59	2	32	28	21.0	14.1
G51	37	52	11	31	57	12	32	54	13	30	56	14	30	30	29.7	25.7
G52	37	55	7	31	60	9	39	52	8	34	56	10	45	46	95.6	76.8
H	53	44	3	47	50	3	44	52	4	41	55	4	48	47	51.2	45.3
I6063	47	50	3	42	53	5	48	45	7	37	54	9	25	24	10.4	8.6
I64	65	27	8	49	41	10	58	32	10	41	44	14	7	16	2.0	3.5
J	21	63	15	15	67	18	8	62	30	7	60	33	33	30	12.8	10.1
K7071	22	59	19	19	66	15	6	58	36	17	55	27	37	32	6.5	5.0
K7273	4	27	69	9	42	49	1	45	54	4	47	50	22	28	4.3	7.2
K74	16	51	32	12	53	35	18	47	35	14	54	32	29	29	196.1	244.1
L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
M	2	42	56	0	40	60	6	26	68	0	27	73	64	70	1.2	1.4
N	7	43	50	6	43	51	1	13	86	1	12	87	53	56	71.9	71.3
O	25	70	5	23	71	6	28	61	11	27	61	12	61	64	47.7	47.0
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total	29	52	19	23	55	22	32	46	22	26	51	23	36	36	701.8	694.5

Table 15 Employees and their formation level and gender in 2000 and 2005, non homogenised data (% and 1000 persons)

Products	Formation level female employees (%)						Formation level male employees (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	40	2	46	50	4	63	36	2	47	50	3	31	28	23.7	26.5
C	17	70	13	12	73	15	60	32	7	43	49	7	8	8	3.7	3.1
DA	41	53	6	35	57	8	57	35	8	38	54	8	36	37	88.5	88.2
DB+DC	54	43	3	46	50	4	57	38	5	48	46	5	50	47	54.1	40.4
DD+DE	26	59	14	20	62	18	55	36	9	33	58	10	27	27	62.6	56.1
DF+DG	20	57	22	15	59	26	46	33	21	19	58	23	24	27	78.3	75.6
DH+DI	33	58	9	26	63	11	57	36	7	39	54	8	16	16	58.6	56.0
DJ	30	61	10	25	64	11	56	38	6	38	55	6	9	10	101.5	99.0
DK+DL	35	55	9	28	60	12	50	35	15	26	59	15	21	21	97.0	83.0
DM	36	56	8	30	60	10	55	39	6	38	55	7	10	11	63.6	56.1
DN	45	52	3	37	59	4	56	40	4	43	52	5	23	24	27.7	24.6
E	16	67	17	9	69	21	48	35	16	18	65	17	15	20	27.1	24.1
F	17	72	11	15	72	13	58	39	3	48	49	4	5	6	188.9	189.1
G50	29	64	7	22	70	8	58	37	5	33	61	6	17	19	56.5	61.1
G51	22	65	13	17	69	14	49	37	14	26	60	14	34	35	180.9	195.3
G52	36	58	5	30	64	6	56	36	8	32	60	8	67	66	195.7	223.2
H	50	48	2	45	52	2	64	34	3	38	59	3	53	52	97.0	105.7
I6063	18	70	12	16	71	14	57	38	5	41	52	7	21	21	200.7	201.3
I64	35	58	8	29	62	9	53	39	8	38	51	10	31	31	80.0	77.5
J	12	68	20	9	69	22	33	34	34	7	59	35	48	50	132.3	128.8
K7071	40	52	9	30	59	11	51	36	13	31	55	14	48	48	24.3	29.7
K7273	5	54	41	4	54	42	19	34	47	4	49	47	30	29	43.0	48.0
K74	36	49	15	30	55	15	44	38	17	31	51	18	49	50	320.4	344.9
L	30	57	12	24	61	15	49	35	17	27	55	18	44	46	388.1	418.8
M	12	67	22	9	69	22	14	47	39	6	57	37	66	68	315.1	338.5
N	23	67	9	19	71	10	38	41	21	26	53	21	79	79	331.7	391.6
O	29	57	14	27	58	15	44	34	22	29	49	21	55	54	101.6	110.1
P	57	42	1	53	46	1	58	41	2	66	32	2	96	96	64.4	67.1
Total	28	59	12	23	63	13	49	37	14	31	55	14	44	46	3407.1	3563.4

Table 16 Employees and their formation level and gender in 2000 and 2005, product technology without correction (% and 1000 persons)

Products	Formation level female employees (%)						Formation level male employees (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	57	40	2	46	50	4	57	41	2	47	50	3	31	28	24.3	26.5
C	17	70	13	11	73	16	51	41	7	43	49	7	8	7	5.3	4.5
DA	42	52	6	36	57	7	47	46	7	39	54	7	36	37	86.4	90.7
DB+DC	56	42	3	47	49	4	58	37	5	51	45	5	53	48	51.4	39.3
DD+DE	26	59	14	20	62	18	40	51	9	33	58	9	26	27	61.8	55.9
DF+DG	19	57	24	15	58	27	24	53	22	18	59	23	23	25	67.9	64.5
DH+DI	35	57	7	27	63	10	47	46	7	39	54	7	16	16	63.6	58.7
DJ	30	62	8	26	65	10	48	47	5	40	55	6	8	9	100.3	93.7
DK+DL	37	55	9	30	59	11	32	53	14	27	59	15	20	19	108.4	96.4
DM	36	55	9	28	61	12	46	48	6	38	55	7	9	10	59.4	49.0
DN	47	51	2	40	57	3	54	43	4	46	51	4	22	23	27.0	20.3
E	15	68	17	9	70	20	23	60	17	17	67	16	15	20	24.6	21.6
F	15	74	11	14	74	12	58	39	3	49	48	3	5	5	196.3	180.9
G50	31	63	6	23	70	6	42	53	5	34	61	5	19	15	63.1	54.7
G51	20	67	13	16	70	14	30	56	14	25	61	13	35	36	196.5	224.4
G52	37	59	5	30	64	5	41	54	4	33	60	6	72	69	171.7	208.2
H	50	48	2	45	52	2	43	54	3	38	59	3	53	52	102.3	108.5
I6063	17	71	12	15	72	14	50	45	5	42	52	6	20	21	195.5	203.8
I64	35	58	7	30	62	8	48	44	7	39	51	10	30	31	81.9	76.0
J	12	68	20	9	69	22	9	58	33	7	59	35	48	50	129.7	123.8
K7071	40	52	8	29	60	11	-1	74	27	29	56	15	70	46	19.3	34.4
K7273	1	52	46	3	52	45	2	49	49	3	48	49	27	32	64.8	77.3
K74	38	48	14	31	54	15	37	46	17	32	51	18	51	51	311.3	344.8
L	31	57	12	24	61	15	34	49	17	27	55	18	43	46	365.8	392.7
M	11	67	22	9	70	22	7	54	39	6	58	36	66	68	314.6	327.7
N	23	67	9	19	71	10	30	49	21	26	53	21	79	79	334.7	393.6
O	27	57	16	25	58	17	29	49	22	29	50	22	53	53	114.7	124.3
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	28	59	12	23	63	13	37	49	14	31	55	14	44	46	3407.1	3563.4

Table 17 Employees and their formation level and gender in 2000 and 2005, product technology plus corrections, final result (% and 1000 persons)

Products	Formation level female employees (%)						Formation level male employees (%)						Women (%)		Employment (x 1000)	
	2000			2005			2000			2005			2000	2005	2000	2005
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
A+B	58	40	2	45	51	4	57	41	2	47	50	3	31	27	25.0	27.1
C	17	70	13	11	74	15	51	41	7	43	49	7	8	7	5.4	4.5
DA	42	52	6	36	57	7	47	46	7	39	54	7	36	38	85.3	89.6
DB+DC	56	42	3	47	49	4	58	37	5	51	45	5	53	48	51.3	39.3
DD+DE	26	59	14	20	62	18	40	51	9	33	58	9	26	27	61.8	55.4
DF+DG	18	57	25	15	58	27	24	53	23	18	59	23	22	25	66.8	63.2
DH+DI	35	57	7	27	63	10	47	46	6	39	54	7	16	16	63.3	58.4
DJ	30	62	8	26	65	9	48	47	5	40	55	6	8	9	100.2	93.6
DK+DL	37	55	9	30	59	11	32	53	14	27	59	15	20	19	107.6	95.7
DM	36	55	9	28	60	12	46	48	6	38	55	7	9	9	58.6	47.9
DN	47	51	2	40	57	3	54	43	4	46	51	4	22	23	27.0	20.3
E	15	68	17	9	71	19	23	60	17	17	68	15	15	20	24.5	21.0
F	30	61	9	15	75	10	57	40	3	49	48	3	6	5	196.8	181.3
G50	31	63	6	23	71	6	42	53	5	34	61	5	19	15	63.3	54.9
G51	20	67	13	16	70	14	30	56	14	25	61	13	35	36	197.0	225.7
G52	37	59	5	30	64	6	41	54	4	33	60	7	72	69	172.7	209.0
H	50	48	2	45	52	2	43	54	3	38	59	3	53	52	102.9	108.5
I6063	16	71	13	15	72	14	50	45	5	42	52	6	20	21	195.0	202.9
I64	36	58	7	30	62	8	48	44	7	39	51	10	30	31	81.4	76.1
J	12	68	20	9	69	22	9	58	33	7	59	35	48	50	129.9	124.0
K7071	29	61	10	29	60	11	29	55	16	29	56	15	60	46	19.1	34.5
K7273	1	52	46	3	52	45	2	49	49	3	48	49	27	32	64.8	77.4
K74	37	48	14	31	54	15	37	46	17	31	51	18	51	51	315.5	347.1
L	31	57	11	24	61	14	34	49	17	27	55	18	43	46	362.8	392.3
M	11	67	22	9	70	22	7	54	39	6	58	36	66	68	314.4	327.6
N	23	67	10	19	71	10	30	49	21	26	52	21	79	79	335.6	394.8
O	27	58	16	25	58	17	29	49	22	29	50	22	54	53	114.6	124.2
P	57	42	1	53	46	1	68	31	2	66	32	2	96	96	64.4	67.1
Total	28	59	12	23	63	13	37	49	14	31	55	14	44	46	3407.1	3563.4

Table 18 The employment "gains" and "losses" of activities (products) compared to industries (in 1000 workers and %)

Symbol	Description of product or industry (ordered by the difference in 1000 workers in the case of product technology in 2005)	Differences with non homogenised data (1000 workers)				Difference in percent of non homogenised employment			
		Product technology		Industry technology		Product technology (%)		Industry technology (%)	
		2000	2005	2000	2005	2000	2005	2000	2005
G51	Wholesale trade and commission trade services	18.0	32.7	45.8	49.1	9	15	22	22
K7273	Computer and related activities; Research and development	22.4	31.1	27.7	47.8	48	58	59	89
DK+DL	Machinery & equipment; Electrical & optical equipment	10.8	13.2	15.9	14.5	11	15	16	17
O	Other community, social and personal services	12.4	12.9	20.3	20.2	8	8	14	13
K7071	Real estate and rental services	-4.4	4.7	19.3	18.7	-15	13	64	53
H	Hotel & restaurant services	8.2	4.2	4.1	3.7	6	3	3	2
DA	Food products, beverages & tobacco	-3.0	2.5	4.0	8.5	-3	3	4	9
DH+DI	Rubber & plastics; other non metallic mineral products	4.4	2.2	2.6	0.1	7	4	4	0
K74	Other business services	-10.1	2.0	-5.3	-2.0	-2	0	-1	0
I6063	Transport services	-6.1	1.9	-9.4	8.3	-3	1	-4	4
N	Health and social work services	4.4	1.9	1.2	-0.1	1	0	0	0
C	Mining and quarrying	1.7	1.4	1.8	1.2	46	45	48	37
A+B	Agriculture, hunting, forestry & fishing	2.6	0.7	1.9	-0.7	3	1	2	-1
P	Private households with employed persons	0.0	0.0	0.0	0.0	0	0	0	0
DD+DE	Wood, paper & printing services	-1.5	-0.6	0.2	2.3	-2	-1	0	4
DB+DC	Textiles, leather & their products	-3.7	-1.5	-2.6	-2.3	-6	-3	-4	-5
I64	Postal and Communication services	0.8	-1.7	-2.0	-5.0	1	-2	-2	-6
E	Electrical energy, gas, steam & water	-2.6	-3.2	-1.8	-1.0	-9	-13	-7	-4
DN	Other manufactured goods	-0.2	-4.5	-2.0	-7.4	-1	-16	-6	-26
J	Financial intermediation services	-2.3	-4.8	-1.5	-3.7	-2	-3	-1	-3
DJ	Basic metals & fabricated metal products	-1.6	-5.2	-1.7	-7.2	-2	-5	-2	-7
G50	Trade, maintenance & repair of motor vehicles & motorcycles, retail trade of automotive fuel	9.2	-6.6	4.9	-12.3	12	-9	7	-16
DM	Transport equipment	-5.1	-8.3	0.9	-0.9	-8	-15	1	-2
F	Construction activities	9.5	-9.1	6.5	-11.1	4	-4	3	-5
M	Education services	3.5	-10.9	-6.8	-27.3	1	-3	-2	-8
DF+DG	Coke, refined petroleum products & nuclear fuel; chemicals, chemical products & pharmaceuticals	-11.5	-12.4	4.1	6.3	-15	-16	5	8
G52	Retail trade & repair services	-26.5	-15.8	-93.2	-54.7	-9	-5	-32	-18
L	Public administration & defense services, compulsory social security	-29.5	-26.5	-35.0	-44.9	-8	-6	-9	-11
Total	Total economy	0.0	0.0	0.0	0.0	0	0	0	0