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Qualitative Employment Multipliers for the Belgian Environmental Industry

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Abstract - The present paper computes cumulative employment generated by the Belgian environmental industry. Relying on Belgian input-output tables for the year 2000 and on detailed employment data (SAM sub-matrix), we investigate the patterns of the employment in the environmental industry, by considering the worker types differentiated by gender, educational attainment or a combination of these characteristics. The employment multiplier analysis of environmental employment reveals some interesting differences between employment of the overall economy and environmental employment for the level of education as well as for the gender type.

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Executive Summary

The present paper computes cumulative employment generated by the Belgian environmental industry. The characteristics of this environmental employment are also investigated. The environmental industry commonly refers to the activities aiming at protecting the environment in the broad view. These activities may be exercised by firms belonging to different Nace-type of industries. Recent developments on the field of environmental protection and regulation have triggered an increasing interest since new job opportunities may be created and new skills may be required. Hence, in order to contribute to the international debate, the present analysis aims at improving our knowledge about the employment in the Belgian environmental industry in inferring its extent and in providing a qualitative analysis of it.

To do so, relying on Belgian input-output tables for the year 2000, *relative employment multipliers* are computed and a *qualitative analysis* of these employment multipliers is performed. These employment multipliers provide, for industry disaggregations of the environmental industry, the direct and cumulative labour use of worker types differentiated by gender, educational attainment or a combination of these characteristics.

Our computations show that between 2000 and 2005 the environmental employment has known a larger growth in terms of employment than the employment of the overall economy. The relative employment multiplier in the environmental industry is also higher than the one for the overall economy (1.8 and 1.5 respectively). In addition, some interesting differences between total employment and environmental employment are worth highlighting. The share of female employment in total employment, which is well-known to be smaller than the share of male employment, is even much more so in the environmental industry. As for the education level, we establish that the *upper secondary* education level provides the larger part of employment – both for the total economy and the environmental industry. The *tertiary short type* education level also retains the attention, since it provides the most noticeable differences between total economy and environmental industry –the share in total employment being higher than the environmental one. We also note that for the lowest education levels, the overall economy presents shares of employment that are smaller than the shares in the environmental industry. Finally, crossing the information about gender and education of employees working for environmentally active firms reveals that on the level of *tertiary short type* education, the share of women is higher than men. Moreover, men present for the lowest levels of education higher employment shares in the environmental industry in cumulative terms than in the total economy, whereas the reverse is observed for women.

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1. Introduction

The environmental industry commonly refers to the activities aiming at protecting the environment in a broad view. According to the OECD and Eurostat, the environmental industry corresponds to all activities which consist in providing goods and services used *to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems. This includes cleaner technologies, products and services that reduce environmental risk and minimize pollution and resource use*.[1] Despite its apparent completeness, the latter definition allows various interpretations concerning the boundaries of the environmental industry.

Such vagueness may be viewed as a solid hindrance for the recent and various researchers' attempts to investigate the issues of the environmental industry.[2] For many years, while the definition of the environmental industry has been the centre of an intense discussion, an increasing interest in the development of the environmental industry arose at an international level.[3] The reason is twofold. Firstly, the recent growth of the environmental industry is, more and more, viewed as a new potential and promising source for economic growth. Secondly, as a consequence of the development of environmental industry, new skills may be required and job opportunities may be created. That second point is particularly relevant since in case of an important development of the environmental industry, it is critical to have good connections between the new domestic job requirements and the available skills available in the national labour supply. Hence, in order to forecast eventual mismatches, it is necessary to improve our knowledge about the characteristics of the employment in the environmental industry. Thus, contributing to the international debate, the present analysis provides a qualitative analysis of the employment in the Belgian environmental industry.

Qualitative employment multipliers can be used for that purpose. These employment multipliers provide the direct and indirect labour use of worker types differentiated by gender, educational attainment or a combination of these characteristics by industry. Computing employment multipliers allows a comparison across the industry disaggregations of the environmental industry in terms of employment. In the present analysis, the employment multipliers are presented as

1 This definition of the environmental industry has been used by OECD / Eurostat Informal Working Group (1996) and has been adopted in the "Manual for Data Collection and Analysis" of the OECD (1999). For further details, see FPB Working Paper 7-09 "The Belgian environment industry (1995-2005)", Janssen & Vandille (2009)

2 For example, see DG Environment (European Commission), 2006, "Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU" or UNEP, 2008, "Green Jobs: Towards decent work in a sustainable, low-carbon world",

3 The term "industry" generally refers to a specific classification of the national activities (the Nace code, for instance). In that context, there exists, stricto sensu, no "environmental industry" Nevertheless, in the present analysis, and in line with the related literature, we use the term "environmental industry" in order to refer to activities identified amongst domestic industries as having an environmental purpose. On their turn, these environmental activities are categorized into environmental sub-industries reflecting the Nace-industry of the firms with environmental activities. See Section 3 below for further information.

the ratio of the cumulated employment over the direct employment, indicating the cumulated number of workers per worker directly involved in the production of goods and services.

Thus, aiming at performing a qualitative analysis of the employment in the Belgian environmental industry, cumulative employment and employment multipliers are discussed. For this purpose, Belgian input-output tables for the year 2000 are used to perform the analyses. The methodology for computing such qualitative employment multipliers is presented in section 2. Section 3 deals with the environmental industry and its boundaries. In fact, in order to provide an accurate grasp of the environmental industry, the present study uses the database of the Federal Planning Bureau about the composition, the economic importance and the evolution of the Belgian environmental industry from 1995 to 2005.[4] This dataset, by adopting a restrictive version of the definition of the environment industry considered by the OECD / Eurostat, provides an accurate framework for the analysis of the environmental industry. Section 4 displays and discusses the results and section 5 provides some concluding remarks.

4 The database was computed by Janssen & Vandille. For further details, see FPB-Working Paper 7-09 "The Belgian environment industry (1995-2005)", Janssen & Vandille (2009)

2. Computing Qualitative Employment Multipliers

On the basis of national input-output tables for a given year, one can straightforwardly compute economic multipliers for the different industries of the economy. These input-output multipliers are based upon the Leontief inverse. As an extension of output multipliers, employment multipliers show the employment that is cumulatively (directly and indirectly) used in the production process by an additional unit of output. As a result, employment multipliers help in describing the labour use in a given economy.[5]

The general formula to compute the employment multiplier m_k for an additional unit of output in a given industry k is as follows:

$$m_k = l'(I - A^d)^{-1} b_k \qquad (1)$$

Where l' denotes a line vector of employment to output coefficients.[6] $(I - A^d)^{-1}$ denotes the Leontief inverse (with I, the identity matrix and A^d, the matrix of technical coefficients for domestically produced intermediate inputs). b_k denotes a column vector of zeros except for the 1 in the element that corresponds to industry k.

Hence, as one can note, the post-multiplication of the Leontief inverse by the vector b_k results in the fact that only the column corresponding to the output shock in industry k is preserved. Afterwards, the pre-multiplication of the latter product by the line vector of employment to output coefficients provides the employment multiplier.

Qualitative employment multipliers also determine the total number of workers that have been involved directly and indirectly in the production process of one unit of a specific product. Their specificity is to be found in the fact that they additionally differentiate workers by qualitative characteristics such as gender, professional status, educational attainment or a combination of these characteristics.[7]

The general formula to compute the vector m_k^Q of qualitative employment multipliers for an additional unit of output in a given industry k is as follows:

$$m_k^Q = L\,(I - A^d)^{-1} b_k \qquad (2)$$

5 Note that input-output industries are homogeneous industries, which are industries producing only one product. Throughout the present section 2, the word industry is a substitute for product.

6 Each element of the vector l is the ratio between the employment and the output of product i. Both output and employment refer to data on homogenous (that is single product) industries. For further information about the homogenization of employment, see the FPB-note SDDS1955 "Homogenization of detailed employment data", Van den Cruyce (2008).

7 For further discussion about the qualitative multipliers, see FPB-Working Paper 15-07 " Qualitative Employment Multipliers for Belgium, Results for 2000 and 2002", Van den Cruyce (2007).

Where L denotes an employment coefficient matrix, that is to say a matrix of employment to output ratios given by:

$$L = S\,\hat{g}^{-1} \qquad (3)$$

$\hat{g}^{-1}$ is an inverse diagonal matrix of output (=production) by product. S denotes a matrix within its columns industries and in its rows combinations of labour types (i.e. gender and education level). S reflects the number of persons in their main occupation. The information about the labour types in table S is based on the SAM sub-table of labour demand[8]. Note that before entering the matrix S, the employment data had to be homogenized[9]. This is because, like in the national accounts, the industries in the SAM sub-table can hold secondary activities (e.g. trade in manufacturing industries), while in the IO table, industries are single product.

Each element in the vector m_k^Q yields the cumulative employment multiplier of a specific labour type. These multipliers are absolute multipliers. That is to say, they give cumulative employment used in the production process to generate one unit of output for product k.

Instead of absolute employment multipliers, it is also possible to work with relative employment multipliers. A relative employment multiplier is the ratio of the cumulated and the direct employment multiplier. It is an indicator of the relative importance of indirect employment generation by an industry with respect to its direct employment generation.

Since indirect employment is generated by the intermediate demand for domestic production, one can compute direct employment multipliers by dropping the Leontief inverse – responsible for introducing the indirect effects – in formula (2), which yields:.

$$d_k^Q = L\,b_k \qquad (4)$$

Actually, the vector d_k^Q converts (one unit) product shocks into direct effects by labour type.

It is possible to compute a vector of relative employment multipliers by dividing each element of vector m_k^Q with the corresponding one in vector d_k^Q. However, it is not guaranteed that these relative employment multipliers by labour type add up to the overall relative employment multiplier.

To avoid this additivity problem our vector of qualitative relative employment multipliers is defined as the ratio of each element of vector m_k^Q to the direct employment multiplier d_k, which is the multiplier for all different types of labour combined in industry k.

8 That table compiled at the Federal Planning Bureau, details industry employment totals by gender, professional status, age class and education level. It holds annual data for the period 1999-2007. For a description of the compilation method, see Bresseleers, V. et al (2007).

9 The method used for homogenization employment detailed by gender, education level and professional status is discussed in the FPB-Note SDDS1955 "Homogenization of detailed employment data", Van den Cruyce (2008).

Thus

$$r_k^Q = m_k^Q (1 / d_k) \qquad (5a)$$

$$d_k = i' d_k^Q \qquad (5b)$$

A multiplier of the type r_k^Q shows the relative importance of cumulative employment of type Q generated by one unit of output of industry k with respect to direct employment of all types generated by one unit of output of industry k. Summing over the different quality types of labour results in the relative employment multiplier r_k for industry k.

Finally, remark that the fact that industries in formulas (1) to (5) are single product poses a particular problem for the recycling industry (Nace 37). This is because this industry has no proper product in the input-output-table, and therefore no separate coefficient in the matrix A^d. We will return to this problem later on.

3. Defining the Environmental Industry

The environmental industry generally refers to all the activities aiming at measuring and protecting the environment in a broad sense.[10] Despite the eventual usefulness of such an exhaustive characterization of the environmental industry, the problem with this kind of definition is the identification of the industry and its borders. In fact, the protection of the environment involves the contribution of many companies from very different industries. All these companies work at the development, the production and the use of a wide range of goods and services both for domestic use and sales abroad in order to provide other (non -) environmental goods.

Hence, defining the environmental industry, the dilemma is at the same time to cover the wider array of activities while circumscribing in a more accurate way the boundaries of this environmental industry. That challenge has been taken up, in particular, for Belgium for the period 1995-2005 by Janssen & Vandille (2009). In fact, by considering a restricted version of the OECD and Eurostat definition of the environmental industry, Janssen & Vandille (2009) have built a database that identifies environmental activities on the basis of the purpose of the activities performed.

Following the OECD Manual, two main categories are defined for the activities of the Belgian environmental industry: *pollution management activities* and r*esource management activities.* Pollution management activities refer to goods and services that are produced with an environmental purpose of having a reducing impact on pollution emissions.[11] Resource management activities refer to goods and services which are focused on altering resource use in a process. They may be associated with environmental protection, although this is not necessarily their prime purpose.[12] As stated by Janssen & Vandille (2009), the share of the Belgian environmental industry in 2005 in the total output of Belgium was about 2.2%, while its share in the total Belgian employment was estimated at 2%. As shown by these authors for the period 1995-2005, the number of firms operating in the Belgian environmental industry has known an extraordinary expansion (by 44%). This rise of the number of firms being part of the Belgian environmental industry matches with an increase of both its turnover (by 22%) and its employment (by 40%).

10 The concept of the "green economy", recently launched by the United Nations Environmental Programme (UNEP), covers a wider array of activities than the environmental industry refers to. In fact, the UNEP (2008) considers as part of the "green economy" all activities involved in a more sustainable consumption and / or production process.

11 Do note that the activity may still be performed for other purpose also.

12 The purpose of the resource management group activities are also economic, like energy saving or recycling of materials. For further details, see FPB-Working Paper 7-09 "The Belgian environment industry (1995-2005)", Janssen & Vandille (2009)

Table 1 - Relative importance of the environmental sub-industries (Belgium, 2000)

		Share in environmental activities		Share in total economy	
	Industry/ final demand product	Employment	Turnover	Employment	Final demand
Nace 01-02 &14	Agriculture, hunting, forestry, mining & quarrying	0.32%	0.50%	2.39%	0.80%
Nace 15	Manufacture of food products	0.42%	0.61%	2.30%	5.23%
nace 17	Manufacture of textile	0.15%	0.01%	1.02%	1.56%
Nace 20-22	Manufacture of wood, pulp, paper, printing & publishing	0.40%	0.78%	1.63%	1.76%
Nace 24-25	Manufacture of chemical products - plastic & rubber	7.53%	17.15%	2.42%	8.10%
Nace 26	Manufacture of other non metallic mineral products	1.85%	1.76%	0.84%	0.84%
Nace 27	Manufacture of basic metals	3.13%	7.52%	0.93%	3.39%
Nace 28	Manufacture of metal products excl. machines & equipment	4.06%	2.73%	1.61%	1.06%
Nace 29	Manufacture of machines & equipments	3.53%	3.34%	1.05%	2.85%
Nace 30-36	Manufacture of office machinery, furniture, transport equipment, precision, electric and electronics devices	3.99%	2.84%	3.59%	9.83%
Nace 37	Recycling	3.44%	8.07%	0.08%	0.00%
Nace 40-41	Electricity, gas & water supply	4.14%	4.11%	0.66%	1.03%
Nace 45	Construction	10.36%	8.70%	5.86%	5.54%
Nace 50	Trade, repair of motor vehicles	0.26%	2.03%	1.81%	2.15%
Nace 51	Wholesale trade excl. motor vehicles	2.92%	5.78%	5.03%	6.10%
Nace 52	Retail trade excl. motor vehicles	0.03%	0.07%	7.05%	3.75%
Nace 55	Hotels & restaurants	0.00%	0.00%	3.44%	2.20%
Nace 60-61 & 63-64	Transport, storage & communication	1.40%	1.21%	6.83%	6.72%
Nace 65-67	Financial intermediation	0.01%	0.03%	3.60%	2.43%
Nace 70-73	Real estate, renting and business activities	3.79%	1.53%	1.84%	8.20%
Nace 74	Other business activities	14.71%	11.02%	12.63%	2.93%
Nace 75	Public Administration	17.87%	6.34%	9.52%	5.56%
Nace 80 & 85	Education, health & social work	3.63%	0.94%	17.77%	10.77%
Nace 90	Sewage and refuse disposal	11.30%	12.62%	0.19%	0.17%
Nace 91-93	Activities of membership, cultural & sporting activities	0.75%	0.33%	3.30%	2.11%
Other Nace	Industries or products without environmental activities	0.00%	0.00%	2.59%	4.90%

Source: Computations based on industry level national accounts data and on Janssen & Vandille (2009)'s dataset for the environmental activities by Nace-industry.

Note that despite considering a restricted version of the OECD and Eurostat definition of the environmental industry, a wide array of different industries is identified as containing environmental firms. The traditional activities of the environmental industry such as Recycling activi-

ties (Nace 37) and Sewage and Refuse disposal activities (Nace 90) only account for 34% of the total number of firms of the Belgian environmental industry, about 20% of total environmental turnover and about 15% of environmental employment. Janssen & Vandille (2009) establish that while manufacturing activities only represent 11% of the environmental firms, about 40% of the Belgian environmental turnover and around 27% of the environmental employment is generated by the manufacturing industry.

Table 1 above displays the composition of the Belgian environmental industry by environmental sub-industry in 2000 both in terms of employment and turnover. Each sub-industry's share in environmental employment (column [1]) can also be compared with its share in total employment (column [3]). The share in environmental turnover cannot be compared with an economy wide equivalent, but in the last column of Table 1, the total final demand share of the products that correspond to each sub-industry in the table is provided[13].

It may be surprising that the largest contribution to the Belgian environmental turnover or employment is not attributed to traditional environmental activities (Nace 37 or Nace 90). While more important in the Belgian environmental industry than in the total economy, these activities only run up, at their best, to the second position (Nace 90 in turnover shares).

In terms of environmental employment "Public administration" (17.9%), "Other business activities" (14.7%), "Sewage & refuse disposal" (11.3%), and construction (10.3%) are the most important activities. Note that the industry "Education, health & social work" that has the largest share (of 17.7%) in total employment only has a share of 3.6% in environmental employment.

The activities generating the most important environmental turnover are "Chemicals" (17.2%), "Sewage & refuse disposal" (12.6%), "Other business activities" (11.0%) and "Construction" (8.7%). The "Recycling" activity is the next with a share of 8.07% in Belgian environmental turnover. These five activities have a total share of 57.6% of the total Belgian environmental turnover and of 47.3% in total Belgian environmental employment.

From the last two columns of Table 1 one can compute the joined share of these five activities in total employment and final demand. Their share in total employment is only 21.2% and their share in final demand is even less with 16.7 %. From this, one can fairly conclude that the industries that generate most environmental activities typically offer services or sell raw materials and/or intermediate goods to other firms, instead of selling investment or consumer goods. The only exceptions in this respect are "Construction" activities, which (with 5.5%) still have a reasonable share in final demand.

As for labour intensity, the environmental industry holds both labour intensive (such as the public administration and other business activities) as capital intensive industries (such as chemicals and manufacturing in general).

13 Note that since no product corresponds with recycling activities (Nace 37), its share in final demand is zero.

4. Results

Having a better understanding of the environmental industry in Belgium, the point is to investigate whether specific features can be found about the characteristics of environmental employment. This is the aim of the present section. Both direct employment and cumulated employment for the environmental industry are discussed - as well as total employment for benchmarking purposes.

4.1. Employment Multipliers for 2000

Cumulative employment generated by an industry can be computed by multiplying its absolute cumulative employment multiplier with its output.[14] Another option is to compute the cumulative employment by multiplying direct employment by the relative employment multiplier. The relative employment multiplier of the environmental industry is calculated directly as a weighted average of relative employment multipliers of the environmental sub-industries. The weights are the shares in direct environmental employment of these sub-industries. Hence, the relative employment multiplier for the total environmental industry is computed as follows:

$$\frac{1}{S}\sum_{k=1}^{m} r_k^Q S_k$$

where S_k is the direct environmental employment per industrial activity k, S is total direct employment in the environmental industry, and r_k^Q is the relative employment multiplier for industry k.[15]

Figures on the employment are presented in the following Table 2 for 2000, based on detailed employment data (SAM sub-matrix) and the typology of the Belgian environmental industry adopted.[16] The environmental employment (direct and cumulative employment) and the total employment are presented as well as breakdowns of them in terms of educational attainment and/or gender type.

From the upper part of Table 2, one can straightforwardly see that the environmental industry provides a higher relative employment multiplier (1.8) in comparison with the total employment (1.5). This implies that per unit of direct employment more indirect jobs are needed to produce environmental output than to produce total output in Belgium. Such a result is ex-

14 Note that the computation of the employment multiplier for the total economy has consisted in deriving a multiplier being a weighted average of employment multipliers of the different industries of the economy by using their shares of final demand as weights.

15 The computations are made on the basis of a disaggregation of the environmental industry in 36 industries

16 This year was chosen because currently, this is the last year for which a symmetric Belgian input-output table, compiled on the basis of a complete database, exists.

pected given the relative large weight (compared to the total employment) in terms of employment of activities such as "Manufacture of chemical products" (7.5% versus 2.4%) or "Manufacture of basic metals" (3.1% versus 0.9%).[17] We will see in the next subsection that the latter activities also tend to have high relative employment multipliers.[18]

Table 2 - Employment and Employment Multipliers for 2000[19]

By share in the	Environmental employment		
	Direct employment	Cumulative employment	Total economy
Employment (1)	67	120	3,753
Relative multiplier	-	1.81	1.51
Gender (%)			
Men	72.2%	65.3%	57.5%
Women	27.8%	34.7%	42.5%
Breakdown of employment (%) (2)			
Men & Women			
Primary	12.8%	11.4%	11.7%
Lower secondary	23.9%	21.7%	21.3%
Upper secondary	37.1%	36.8%	36.0%
Tertiary short type	12.4%	13.9%	16.4%
Tertiary long type	3.3%	3.6%	3.6%
Academic	10.6%	12.5%	11.0%
Men			
Primary	13.0%	12.5%	12.7%
Lower secondary	25.1%	24.1%	23.5%
Upper secondary	36.2%	36.1%	36.0%
Tertiary short type	10.6%	11.0%	12.1%
Tertiary long type	3.5%	3.5%	3.6%
Academic	11.6%	12.7%	11.9%
Women			
Primary	9.5%	9.3%	10.3%
Lower secondary	16.6%	17.3%	18.3%
Upper secondary	39.8%	38.1%	36.1%
Tertiary short type	19.5%	19.4%	21.9%
Tertiary long type	3.5%	3.8%	3.5%
Academic	11.0%	12.0%	9.5%

Note (1): The figures are in thousands full time equivalents. For information, the total employment (in thousands of persons) is 4,091. The corresponding number is not available for the environmental industry.

Note (2): All breakdowns are based on employment data in terms of number of persons employed.

Note (3): The computation of the employment multiplier for the total economy has consisted in deriving a multiplier being a weighted average of employment multipliers of the different industries of the economy by using their shares of final demand as weights.

17 The percentage are taken from Table 1

18 See Table 3 in subsection 4.2.

19 See in appendix, figures (in thousands) of the employment multipliers and corresponding breakdowns.

Note that the cumulative employment (120,000) in the environmental industry is obtained by multiplying the relative multiplier (1.81) with the direct environmental employment (67,000). This cumulative environmental employment represents the jobs generated by the Belgian environmental industry.[20]

The relative multiplier of 1.5 for the total economy implies that one third of the Belgian employment concerns the production of intermediate goods and services.

Confronting the column of total employment with those of environmental industry reveals noticeable differences in the percentage of women employed. While the female employment in the total employment is about 42.5% in 2000, women only account for 27.8% in the direct environmental employment and 34.7% in the cumulative environmental employment. Hence, an environmental job seems to be mostly a men's job.

The lower part of Table 2 shows the breakdowns of employment per gender type and level of skills. Let us first focus on the breakdown of the employment in terms of education level – men and women being considered together.[21] Considering the percentages presented, some facts deserve to be highlighted. First and foremost, it is worth noting that the *upper secondary* education level is the education level that provides the largest share in the employment. This is particularly true for the environmental industry with a direct environmental employment presenting a share of 37.1% (compared to total employment share of 36%).

Another education level also retains the attention: the *tertiary short type*. Although this education level displays an employment share that is far smaller than the one for the *upper secondary* education level, it provides the most noticeable differences between total employment – where it provides the largest share (16.4%)- and environmental industry (12.4% and 13.9% in terms of direct and cumulative employment respectively).

Moreover, for the lowest education levels (for instance, primary and lower secondary level), while cumulative environmental employment and total employment presents very close shares of employment (11.4% and 21.7% versus 11.7% and 21.3% respectively), direct environmental employment displays shares of employment that are smaller (12.8% and 23.9%).

Crossing the information about gender and education allows going further in the employment analysis. In fact, considering the education breakdown per gender type, one can readily see that the conclusions drawn above concerning the *tertiary short type* education level still hold. Moreover, it is worth highlighting that, for these same education levels (for instance *tertiary short type*), women show employment shares that are larger than those for men.

20 One can interpret 120 / 3,753 = 3.2% as a proxy of the share of Belgian employment generated by the environmental industry. An accurate estimate of the share of Belgian employment generated by the environmental industry is not trivial since what concerns the Belgian environmental industry no data is available on the final demand for the environmental industry.

21 See in appendix, the corresponding Table 2bis with the breakdowns expressed in terms of full time equivalents.

Furthermore, note that men present on the lowest education levels (for instance, primary and lower secondary level) employment shares that are slightly higher in the environmental industry (both in direct and cumulative terms with 13.0% and 25.1%, and 12.5% and 24.1% respectively) than in the total economy (12.7% and 23.5% respectively). The reverse is observed for women such that, for these same education levels, the shares in the employment in the total economy (10.3% and 18.3% respectively) are clearly higher than in the environmental industry (both in direct and cumulative terms with 9.5% and 16.6%, and 9.3% and 17.3% respectively). In addition, for primary and lower secondary level of education, women also display employment shares that are significantly lower than the shares of the men.

4.2. Sub-industry Analysis of Employment Multipliers

In addition, as mentioned previously in section 3 a sub-industry analysis of the environmental industries that are important (in terms of employment for instance) can help for a better understanding of the composition of the relative employment multiplier and in particular the breakdown across gender of the cumulative employment. Table 3 below allows such an analysis by providing more detailed results about the main industries in terms of employment of the Belgian environmental industry.

The first column in Table 3 presents the share of the selected industries in the employment of the Belgian environmental industry. The next two columns of Table 3 provide the direct and cumulative environmental employment in Belgium for the year 2000. Analyzing Table 3, one can note that manufacturing activities reveal more indirect employment than services. In fact, activities such as “Public administration” (Nace 75) and “Other business activities” (Nace 74) exhibit the smallest shares in cumulative employment. In fact, the ratio of cumulative employment to direct employment – that is to say the relative employment multiplier- is 1.1 and 1.4 respectively. In contrast, this latter relative employment multiplier is much higher for manufacturing activities such as “Manufacture of chemical products” (Nace 24-25) or “Manufacture of basic metals” (Nace 27) with relative employment multipliers of about 2.5 and 2.4 respectively.

Furthermore, as stated earlier in the upper part of Table 2, the gender breakdown underscores a female presence that is far weaker in the environmental industry. Focusing on the selected industries in Table 3, that is confirmed and particularly in activities which are traditionally known to require more physical work such as “Manufacture of basic metals” (Nace 27) or “Construction” (Nace 45) with a percentage of women of 17.7% versus 14.1% respectively for the cumulative employment.

Table 3 - Employment Multipliers – sub-industry analysis

Nace code	Description	% Environmental employment	Direct employment(*)	Cumulative employment(*)	Relative multiplier	% women in cumulative employment
Nace 24-25	Manufacture of chemical Products - Plastic - Rubber	7.5%	5,009	12,337	2.46	27.9%
Nace 27	Manufacture of basic metals	3.1%	2,085	5,094	2.44	17.7%
Nace 29	Machines & equipment	3.5%	2,346	4,505	1.92	19.7%
Nace 37	Recycling	3.4%	2,288	5,591	2.44	17.7%
Nace 45	Construction	10.3%	6,895	1,499	2.17	14.1%
Nace 51	Wholesale trade excl. motor vehicles	2.9%	1,944	4,023	2.07	34.6%
Nace 74	Other business activities	14.7%	9,787	13,802	1.41	36.4%
Nace 75	Public Administration	17.8%	11,890	13,080	1.10	45.5%
Nace 90	Sewage and refuse disposal	11.3%	7,518	17,722	2.36	24.1%
Other codes		25.2%	16,773	29,569	1.76	29.1%
Environmental total		100.0%	66.5(*)	119.8(*)	1.81	28.2%
Total economy		-		3,752.8(*)	1.51	42.7%

Source: FPB calculations.

Note: (*) in thousands full time equivalents.

4.3. Evolution of Direct Employment between 2000 and 2005

The next Table 4 presents the evolution and composition of the direct employment in 2000 and 2005. Figures for the overall employment and environmental industry are shown.

The upper part of Table 4 shows an increase in the employment both for total employment and for environmental employment between 2000 and 2005. The employment in the environmental industry, however, has known a larger growth during that period than the employment in the total economy (15% versus 3% respectively). In addition, confronting the column of total employment with that of the environmental industry reveals noticeable differences in the percentage of women employed. While the female share in the total employment was about 42.5% in 2000 (44.1% in 2005), women only accounted for 27.8% (28.6% in 2005) in the environmental industry. Nonetheless, a slight increase of the women's share in both total employment and environmental employment over time is worth noting.

Table 4 - Evolution of Direct Employment between 2000 and 2005

	2000		2005		Variation 2000-2005	
	Environmental industry	Total employment	Environmental industry	Total employment	Environmental industry	Total employment
Direct employment	66,535	4,091,325	76,609	4,229,282	15.1%	3.4%
% women	27.8%	42.5%	28.6%	44.1%	0.8%	1.6%
Men & Women						
Primary	12.8%	11.7%	11.0%	9.4%	-1.8%	-2.3%
Lower secondary	23.9%	21.3%	20.7%	18.2%	-3.1%	-3.1%
Upper secondary	37.1%	36.0%	39.1%	38.3%	2.1%	2.3%
Tertiary short type	12.4%	16.4%	14.3%	18.5%	1.8%	2.1%
Tertiary long type	3.3%	3.5%	3.6%	3.8%	0.3%	0.3%
Academic	10.6%	11.1%	11.3%	11.7%	0.7%	0.6%

Source: FPB calculations on the basis on SAM data.

Note: The figures of the direct employment for the environmental industry are in terms of full time equivalents, whereas those of the employment are in terms of persons.

The lower part of Table 4 yields a breakdown of the employment according to the education attainment level (without gender distinction). The analysis of the evolution of the composition of employment reveals several facts.

First, between 2000 and 2005, the *primary* and *lower secondary* levels of education present, both for total and environmental employment, a decrease in their shares in the employment - the decrease being slightly more pronounced in the total employment and larger for the *lower secondary* level. Those decreases are mainly in favour of the *upper secondary* and *tertiary short type* levels of education. The subsequent increase of the employment share in these latter education levels is slightly more pronounced in total employment and more outspoken in the *upper secondary* level. .

From such results, one can wonder about the significance of increasing importance of the employment shares of the *upper secondary* and *tertiary short type* education levels. Clearly, the environmental employment follows the trend of the total employment – even if a slightly lesser extent for the environmental industry has to be mentioned. That trend reveals a mutation in total as well as in the environmental employment towards these latter levels of education at the expense of lower ones with the higher levels of education remaining fairly constant. Such findings are in line with the well-known trend of the general increase of education level.

Secondly, both in 2000 and 2005, for each education level, the total and the environmental employment follow the same patterns.[22] In particular, we see the persistence of the noticeable difference between total and environmental employment for the *tertiary short type* education level (16.4% versus 12.4% in 2000 and 18.5% versus 14.3% in 2005 respectively). At this stage, one can wonder what can explain such a small share for the environmental industry for that level of

22 See comments of Table 2 for further details.

education. Is it a question of education supply or just the consequences of the type of the job offered in the environmental industry? Without any doubt further research is needed in order to address such a question.

5. Conclusions

The present analysis aims at studying the characteristics of Belgian environmental employment. To achieve that purpose *relative employment multipliers* are computed and a *qualitative analysis* of these employment multipliers is performed on the basis of Belgian input-output tables for the year 2000, the detailed employment data (SAM sub-matrix) and the typology of the Belgian environmental industry.

Our investigations of the Belgian environmental employment differentiated by gender, educational attainment or a combination of these characteristics have underscored some remarkable differences between total employment and environmental employment. Firstly, we note that even though both total employment and environmental employment increased over the period 2000-2005, growth in terms of employment was larger for the environmental industry. Secondly, the share of female employment (compared to male employment) is far lower in the environmental industry than it is at the level of the total economy. Nonetheless, in both total economy and environmental industry, we remark that female employment is in increase. Thirdly, concerning the education level, we find out that the *tertiary short type* education level is the level of education that provides the more significant differences between total employment and environmental industry – the share in total employment being higher than the environmental one. Finally, considering in addition the gender types, the figures reveal that gender differences are more outspoken in the environmental employment (in comparison with the total employment). For instance, it is the *tertiary short type* education level that exhibits more pronounced differences: women show employment shares that are markedly larger than the shares of men.

6. Bibliography

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7. Appendix

7.1. Computation of the employment multiplier for the Recycling activities (Nace 37)

Note that the non existence of product defined for the Recycling activities (Nace 37) in the Belgian Nace code makes the computation of relative employment multiplier no trivial. In order to circumvent this obstacle, we use the relative multiplier for the Nace 27 as a proxy for that of Nace 37. This is based on the fact that products from Nace 27 are the main production of the "Recycling" activity representing 56% of its output in 2000[23].

23 According to the Belgian input-output tables 2000, metals were followed by products of rubber or plastics (14%), paper (8%) and trade margins (8%).

7.2. Employment and employment multiplier (in thousands of persons) for 2000

Table 2bis - Employment Multipliers for 2000

	Environmental employment		Total economy
	Direct employment	Cumulative employment	
Employment (in thousands) [1]	67	120	3,753
Gender			
Men	48	86	2,160
Women	18	33	1,593
Breakdown of employment (in thousands) [2]			
Men & Women			
Primary	8	15	438
Lower secondary	16	27	798
Upper secondary	25	44	1,351
Tertiary short type	8	16	615
Tertiary long type	2	4	133
Academic	7	14	417
Men			
Primary	6	12	274
Lower secondary	12	21	509
Upper secondary	17	31	777
Tertiary short type	5	9	262
Tertiary long type	2	3	82
Academic	6	10	258
Women			
Primary	2	3	164
Lower secondary	3	5	290
Upper secondary	7	12	575
Tertiary short type	4	7	354
Tertiary long type	1	1	51
Academic	2	4	160

(1) The figures are in full time equivalent. For information, the total employment (in thousands of persons) is 4,091. The corresponding number is not available for the environmental industry.

(2) All breakdowns are based on employment data in terms of person.