Factors driving the evolution of water consumption examined with a Structural Decomposition Analysis. Application to Spain

Cazcarro, Ignacio [a]*; ***Duarte, Rosa*** [b]; ***Sánchez-Chóliz, Julio*** [c]

[a] Department of Economic Analysis, University of Zaragoza
C/ Gran Vía 2, 50005 Zaragoza (Spain)
Phone: 876 554621 Fax: +34-976-761996 Email: icazcarr@unizar.es

[b] Department of Economic Analysis, University of Zaragoza
C/ Gran Vía 2, 50005 Zaragoza (Spain)
Phone: 976 762213 Fax: +34-976-761996 Email: rduarte@unizar.es

[c] Department of Economic Analysis, University of Zaragoza
C/ Gran Vía 2, 50005 Zaragoza (Spain)
Phone: 976 761826 Fax: +34-976-761996 Email: jsanchez@unizar.es

*Corresponding author

Abstract

The structural decomposition analysis (SDA) has been used to study variations in impacts and resource use (see Rose and Casler, 1996 [11], Hoekstra and Van der Berg, 2002 [5], for a review). Behind the variation of water consumptions in a country, there are components such as water intensities, technology, and levels and composition of the demand, and thus those are the factors examined. In the application for Spain, water consumption series are constructed from both data of Chapagain and Hoekstra (2004)'s [1] -for the agrarian consumption- and the Satellite Water Accounts of the National Statistic Institute -for other accounts' water consumption. They are linked to a time series of input-output tables in constant prices of the Spanish economy. On this environmental and economic basis, both direct changes in water consumption as the embodied water of final demand is broken down into three different effects, intensity, technology and demand. In addition, the technological effect is broken down into five effects, internal, forward, backward, fabrication and substitution. Finally, given the important role of agriculture as a consumer of water, and in addition to the above global analysis, we analyze its role by crops and a rebound effect in agriculture is analyzed for many different crops, i.e. if the changes in water consumption in the Spanish economy lead to increasing the surface of crop cultivation, or if they lead to put in production more water intensive crops.

Key words: Structural decomposition analysis, Constant price series, Water consumption, Spain, Agrarian sector.

Topic: 7.- Structural Change.

1 Introduction

The growth and technological transformation over the last four decades that has taken place in Spain has modified the patterns of resources use, particularly of water use and consumption, having to do both with the direct and embodied contents. This means changes in the water consumed per euro of production, but also technological and demand changes, affecting both, direct users, and indirect users, that is to say, sectors that demand highly water intense products directly and indirectly.

To examine the impact that issues such as the influence of technological change or the increase in demand in Spain in the last decades on the use and consumption of water, we use yearly input-output tables of the period, and apply a differential structural decomposition analysis (SDA). More specifically, this decomposition is applied to the changes in direct water consumption and in the embodied water associated with the Spanish economy, obtaining a structural description of the evolution of water consumption and water flows. On these bases, it is possible to obtain eight components and explaining the evolution of water consumption. The first effect, the "intensity effect" captures changes in direct consumption or embodied water of each sector in the period 1980-2006, assuming that neither the production technology nor final demand changes. If we remember that the biggest consumer is agriculture, changes in the amount of water consumed per unit of agricultural product value will be captured by this intensity effect, which tells us if the final agricultural production is more or less water-intensive per final euro. A second effect that we will look at is the "demand effect", which measures the impact on consumption or embodied water changes in the volume and composition of final demand, under the assumption that the water intensity and productive technologies are the same. Certainly in this second effect have influence both the change in consumption patterns and the population increase during the period examined.

The third effect, called "technological effect", estimates the impact of technological change in water consumption via saving inputs used in production and via substitution of some inputs for others to change production processes. For in-depth analysis, we decompose the technological effect in another five, "internal effect", "forward effect", "backward effect", "fabrication effect" and "substitution effect"[1]. On the one hand, the first of these five effects reflects the impact of technological change in water consumption of a sector (or block of sectors) for its own final demand, while the second and third estimate the impact of technological change in consumption associated with sales and purchases of the sector to and from other sectors. On the other hand, the fourth and fifth share the technological effect on two aspects, saving inputs and varying relevance of certain inputs.

Our starting point therefore is the Leontief demand model where production can be obtained as a product of the Leontief inverse (representative of technology) and a vector that summarizes the net final demands (Final demands minus Imports). We are also extending environmentally some analysis already carried out on the structural and technological change in the Spanish economy in the period 1980-2006. See Duarte and Sánchez Chóliz (2011) [4], where we concluded that growth in the Spanish economy was driven by a mix of technological modernization and scale growth.

Given the particular importance of the agrarian sector in explaining not only the high water volumes, but also the direct and embodied annual changes, in the final subsection (4) of results we look in detail to the productivity, area harvested, and water consumed by crop along the period. The highest average contribution to the total water consumption of the crops comes from olives, barley, grapes, wheat and almonds. They are followed by gramineous and leguminous, chilies, corn, and grasses. From those 9 crops, which represent approximately the 74% of total consumption, 7 of them have increased consumption: olives, barley, wheat, gramineous and leguminous, pepper, corn and grasses, while 2 of them have reduced it, grapes and almonds. These increases and reductions are a reflection of the transformation of crops that the Spanish economy has experienced over the period 1980-2007, changing the weight or proportions to less water-intensive crops per euro. These changes were not static, and as we shall see later, their evolutions are different at the beginning and end of the period.

2 Methodology

As has been established in the introduction, our objective is to explain changes in water consumption in the Spanish economy along the last four decades. To do this, our starting point is the equilibrium equation for a economy on the basis of a Leontief model: $\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{y}$, where $\mathbf{x}$ is a vector of sectoral outputs, $\mathbf{A}$ is the matrix of technical coefficients, and $\mathbf{y}$ the vector of final demands. In what follows,

[1] Stone and Brown (1962) [12], Paelinck and Waelbroeck (1963) [9],..., gave an interpretation of the multiplier s on the right of the rAs procedure as fabrication effect, and analogously the r in terms of absorption effect (what has also been called substitution by Van der Linden and Dietzenbacher (2000) [14] and Dietzenbacher and Hoekstra (2001) [2]), later challenged by de Mesnard (2000) [8].

let us denote by $\hat{}$ the diagonalization of a vector (i.e., a diagonal matrix with only elements in the main diagonal and being these elements those of the vector) and by $'$ the transposition of a vector. We denote by $\mathbf{e}$ the unitary vector. The economic equilibrium $\mathbf{x} = \mathbf{Ax} + \mathbf{y}$ can be also expressed in terms of the Leontief inverse:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{Ly}.$$

Let $\mathbf{W} = (W_j)$ be a vector of direct sectoral water consumption and $\mathbf{w} = (w_j)$ a vector of water intensities with $w_j = W_j/x_j$. Then, the water consumed in the economy is $\mathbf{w}'\,\mathbf{x} = \mathbf{W}'\,\mathbf{e}$, and we can also obtain the matrix $\mathbf{H} = \hat{\mathbf{w}}\mathbf{L}\hat{\mathbf{y}}$ capturing all the water flows in the economy directly and indirectly consumed by sectors to obtain their final demands (the embodied water). A generic element $h_{ij} = w_i L_{ij} y_j$ shows water consumed to obtain the inputs i directly and indirectly consumed by sector j to obtain its final demand. Moreover, it can be seen that the vector of water embodied in final demand can be obtain as $\mathbf{e}'\mathbf{H} = \mathbf{e}'\hat{\mathbf{w}}\mathbf{L}\hat{\mathbf{y}}$, and the direct consumption of water by sector is given by $\mathbf{He} = \hat{\mathbf{w}}\mathbf{L}\hat{\mathbf{y}}\mathbf{e} = \mathbf{W}$.

To study sources of changes in sectoral water uses and water footprints, Structural Decomposition Analysis (SDA) is used. The SDA was defined by Rose and Chen (1991) [10] as "the analysis of economic change through a set of (static and comparable) changes in key parameters of an input-output table", has been used to study variations in impacts and resource use (see Rose and Casler, 1996 [11], Hoekstra and Van der Berg, 2002 [5], for a review). Broadly speaking, SDA techniques aim to break down a time trend of a variable into a group of driving forces which act as accelerators or retardants (Dietzenbacher and Los, 1998 [3]; Hoekstra and van der Berg, 2002 [5]; Lenzen et. al., 2001 [7]). In a general way, considering a variable y depending on n explicative factors $y=f(x_1,\ldots,x_n)$, additive structural decomposition can be obtained through its total differential.

$$dy = \frac{\partial y}{\partial x_1}dx_1 + \frac{\partial y}{\partial x_2}dx_2 + ... + \frac{\partial y}{\partial x_n}dx_n \tag{1}$$

On the basis of a multiplicative relationship between dependent and explicative variables, that is $y = x_1 \ldots . x_n$, expression (1) holds:

$$dy = x_2x_3...x_ndx_1 + ... + x_1x_2x_3...x_{n-1}dx_n = \sum_{i=1}^{n}\left(\prod_{j\neq i} x_j dx_i\right) \tag{2}$$

In a discrete schema, when we try to measure the changes in the dependent variable between two periods, t-1 and t, Δy, there are different ways of solving this expression, which requires to decide among exacts and non-exacts decompositions. In the case of exact decomposition, interpretation of the interaction terms is avoided. However, the well-known problem of non-uniqueness of SDA solution appears, with the results being sensitive to the concrete type of decomposition used. Thus, if decomposition is based on n explicative factors, we can obtain $n!$ exact decompositions and, in practice, as a possible solution, the average of all possible decomposition is used. Nevertheless, as Dietzenbacher and Los (1998) [3] demonstrate, the simple average of the two polar decompositions can be considered as a good approximation to the average of the $n!$ exact decomposition forms, and this will be our choice from now on.

Starting from: $\mathbf{H} = \hat{\mathbf{w}}\mathbf{L}\hat{\mathbf{y}}$, the reiterative application of polar decomposition yields this expression:

$$\begin{aligned}\mathbf{\Delta H} &= {}^1\!/_2\mathbf{\Delta}\hat{\mathbf{w}}\,(\mathbf{L}_0\hat{\mathbf{y}}_0 + \mathbf{L}_1\hat{\mathbf{y}}_1) + {}^1\!/_2\,(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,\mathbf{\Delta}\,(\mathbf{L}\hat{\mathbf{y}}) \\ &= {}^1\!/_2\mathbf{\Delta}\hat{\mathbf{w}}\,(\mathbf{L}_0\hat{\mathbf{y}}_0 + \mathbf{L}_1\hat{\mathbf{y}}_1) + {}^1\!/_2\,(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,[{}^1\!/_2\mathbf{\Delta L}\,(\hat{\mathbf{y}}_0 + \hat{\mathbf{y}}_1) + {}^1\!/_2\,(\mathbf{L}_0 + \mathbf{L}_1)\,\mathbf{\Delta}\hat{\mathbf{y}}] \\ &= {}^1\!/_2\mathbf{\Delta}\hat{\mathbf{w}}\,(\mathbf{L}_0\hat{\mathbf{y}}_0 + \mathbf{L}_1\hat{\mathbf{y}}_1) + {}^1\!/_2\,(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,\mathbf{\Delta L}{}^1\!/_2\,(\hat{\mathbf{y}}_0 + \hat{\mathbf{y}}_1) \\ &\quad + {}^1\!/_2\,(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,{}^1\!/_2\,(\mathbf{L}_0 + \mathbf{L}_1)\,\mathbf{\Delta}\hat{\mathbf{y}}\end{aligned} \tag{3}$$

We can call to the first addend "intensity effect", showing the contribution of changes in water intensity to total water consumption change, "technological effect" to the second one, showing how changes in economic structure and in the technology used contribute to changes in total water consumed, and "demand effect" to the last term, which shows the contribution of changes in final demand to water consumption changes.

Moreover, we can more deeply study the contribution of changes in the economic structure to changes in water consumption focusing the second term of (3). It is known that $\mathbf{\Delta L} = \mathbf{L}_0\,\mathbf{\Delta A}\,\mathbf{L}_1 = \mathbf{L}_1\,\mathbf{\Delta A}\,\mathbf{L}_0$, then

$$\mathbf{\Delta L} = {}^1\!/_2(\mathbf{L}_0\,\mathbf{\Delta A}\,\mathbf{L}_1 + \mathbf{L}_1\,\mathbf{\Delta A}\,\mathbf{L}_0). \tag{4}$$

Which allow us to associate the direct technological changes of the technical coefficient matrix $\mathbf{A}$ with the changes in the Leontief inverse $\mathbf{L}$.

From (4) there are at least two possible ways to deepen the meaning of the technological effect, an analysis by blocks or other relevant sectors and the approximation by homogeneous changes in rows

and columns. Following the first route, as $\mathbf{A}$ can be further decomposed (e.g. in sector 1 and the rest),

$$\mathbf{A} = \begin{pmatrix} \mathbf{A}_{11} & \mathbf{A}_{12} \\ \mathbf{A}_{21} & \mathbf{A}_{22} \end{pmatrix}, \text{ or in general distinguishing } n \text{ sectors or blocks : } \quad \mathbf{A} = \begin{pmatrix} \mathbf{A}_{ii} & ... & \mathbf{A}_{in} \\ ... & ... & ... \\ \mathbf{A}_{ni} & ... & \mathbf{A}_{nn} \end{pmatrix}$$

The technological effect of (4) could be expressed in general as:

$$\mathbf{T} = \begin{pmatrix} \mathbf{T}_{ii} & ... & \mathbf{T}_{in} \\ ... & ... & ... \\ \mathbf{T}_{ni} & ... & \mathbf{T}_{nn} \end{pmatrix} = {}^1\!/_8 \left(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1\right) \left(\mathbf{L}_0 \Delta \mathbf{A} \mathbf{L}_1 + \mathbf{L}_1 \Delta \mathbf{A} \mathbf{L}_0\right) \left(\hat{\mathbf{y}}_0 + \hat{\mathbf{y}}_1\right), \tag{5}$$

allowing us to define for each sector or block i an internal effect, a backward effect and a forward one, which are given[2]

$$\begin{array}{l} \mathbf{T}_{ii} \ , \text{ internal effect} \\ \sum_{j=1, i\neq j}^{n} \mathbf{T}_{ij} \ , \text{ forward effect} \\ \sum_{j=1, i\neq j}^{n} \mathbf{T}_{ji}, \text{ backward effect} \end{array} \tag{6}$$

The first tells us of changes in water consumption sector i crystallized in its own final demand, and are due to technological changes. The second accounts for the changes in water consumption of sector i, induced by technological change, whose destination is the final demand in other sectors. And finally the third, captures changes in the consumption of water from other sectors to generate the necessary inputs, directly or indirectly, for final demand i. In our case this decay is particularly interesting for two sectors, Agrarian S., hunting and forestry and Electricity, gas and water, because they are the main direct consumers.

The other way to interpret the technological effect is associated with a breakdown of $\mathbf{\Delta A}$ similar to that made by Dietzenbacher and Hoekstra (2001) [2] into three different components, homogeneous changes by columns, homogeneous changes in rows, and other changes specifically associated with each cell and that measure differences between the real change and the part of the change captured by the tow first homogenous changes (in columns and rows).

Homogeneous changes in columns of $\mathbf{A}_0$ to $\mathbf{A}_1$ can be obtained by multiplying each column of $\mathbf{A}_0$ by a factor s_j. We assume in these changes that the production technology of each good uses the same proportions of inputs, although the total amount may change. Consequently, $s_j - 1$ represents the change as parts per unit (so much per one) of the total value of inputs purchased by industry j and, if the difference is negative, there is (in value) a lower use of inputs and an improvement of technology. The change collected by $s_j - 1$ may be called fabrication effect (taking into account that the effects we consider are not the pure fabrication and substitution effects, but incorporating the role of water).

Homogeneous change in rows from $\mathbf{A}_0$ to $\mathbf{A}_1$ can be obtained by multiplying each row of the matrix $\mathbf{A}_0$ by a factor r_i, which means maintaining the proportions of sales to each sector, but that its volume can change. The difference $r_i - 1$ measures the percentage change in total sector assets used as inputs the production of the economy. Their positive values indicate the increase in volume of inputs supplied by sector i. Among the key examples of goods that have suffered this kind of positive transformation in recent years we find the computers or financial services. Technological change captured by the $r_i - 1$ could be called substitution effect. Both homogeneous changes allow obtaining the approximation $\mathbf{A}* = \hat{\mathbf{r}}\mathbf{A}_0\hat{\mathbf{s}}$ to the matrix $\mathbf{A}_1$, and also to the error matrix $\varepsilon = \mathbf{A}_1 - \hat{\mathbf{r}}\mathbf{A}_0\hat{\mathbf{s}}$. Unique solutions for vectors $\mathbf{r}$ and $\mathbf{s}$ can be obtained through an iterative process like RAS under these four constrains:

$$\begin{array}{l} \hat{\mathbf{r}}\mathbf{A}_0\hat{\mathbf{s}}\ \hat{\mathbf{x}}_1\mathbf{e} = \mathbf{A}_1\mathbf{x}_1 = \mathbf{u}_1 \\ \mathbf{e}'\hat{\mathbf{r}}\mathbf{A}_0\hat{\mathbf{s}}\ \hat{\mathbf{x}}_1 = \mathbf{e}'\mathbf{A}_1\hat{\mathbf{x}}_1 = \mathbf{v}_1' \\ \text{with} \quad \mathbf{e}'\mathbf{u}_1 = \mathbf{v}_1{}'\mathbf{e} \\ \text{and } \mathbf{e}'\left[\hat{\mathbf{r}}\mathbf{A}_0\mathbf{e} - \mathbf{u}_1\right] = \left[\mathbf{e}'\mathbf{A}_0\hat{\mathbf{s}} - \mathbf{v}_1'\right]\mathbf{e} \end{array} \tag{7}$$

The first three conditions assure us the uniqueness of $\mathbf{A}* = \hat{\mathbf{r}}\mathbf{A}_0\hat{\mathbf{s}}$, but not the one of $\mathbf{r}$ y $\mathbf{s}$, being the solution of any of the pairs $(\lambda\mathbf{r},\ \mathbf{s}/\lambda)$ obtained for a given positive λ, being in general the solutions $\mathbf{r}$ y $\mathbf{s}$ different when the iterative process is started with the adjustment by columns (obtaining $\mathbf{r}_c$,$\mathbf{s}_c$) or by rows (obtaining $\mathbf{r}_r$,$\mathbf{s}_r$). Note that the larger is λ, the greater the burden of adjustment by columns, this is, what we have called the fabrication effect. Consequently, the choice of the pair $(\lambda\mathbf{r},\ \mathbf{s}/\lambda)$ depends on the weight which in the real transformation has had the substitution effect or the technology effect.

To solve this conflict different criteria can be followed. One would be to give preference to the pair ($\mathbf{r}_c$,$\mathbf{s}_c$) obtained when the iteration starts by columns, as this means putting the burden of the change

[2] From (5) is possible to define the internal, forward and backward effects in other ways, some more explanatory, but are also more formally complex. This has led us, in this first analysis, to use the simplest form.

on the change in technology, which is what we are discussing. Another, which is the one chosen in (7), is avoiding giving any preference to any of the effects under lack of information. Therefore, in (7) what we impose is to match the errors obtained with the adjustment by rows **r** and the adjustment by columns **s**. In this case, starting the iterative process to obtain (**r**,**s**) by rows or columns is indifferent.

Moreover, bearing in mind (5) and $\mathbf{A}_0 = \mathbf{I}\,\mathbf{A}_0\,\mathbf{I}$, we can also write

$$\mathbf{\Delta A} = \tfrac{1}{2}\mathbf{\Delta}\hat{\mathbf{r}}A_0\,(\hat{\mathbf{s}}+\mathbf{I}) + \tfrac{1}{2}\,(\hat{\mathbf{r}}+\mathbf{I})\,\mathbf{A}_0\mathbf{\Delta}\hat{\mathbf{s}} + \varepsilon,\ \text{with}\ \mathbf{\Delta}\hat{\mathbf{r}} = \hat{\mathbf{r}} - \mathbf{I},\ \mathbf{\Delta}\hat{\mathbf{s}} = \hat{\mathbf{s}} - \mathbf{I} \tag{8}$$

And as a consequence the technological effect can be decomposed in two effects, with the expressions as follow:

1. $\tfrac{1}{16}(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,[\mathbf{L}_0\,(\hat{\mathbf{r}}+\mathbf{I})\,\mathbf{A}_0\mathbf{\Delta}\hat{\mathbf{s}}\,\mathbf{L}_1 + \mathbf{L}_1\,(\hat{\mathbf{r}}+\mathbf{I})\,\mathbf{A}_0\mathbf{\Delta}\hat{\mathbf{s}}\,\mathbf{L}_0]\ (\hat{\mathbf{y}}_0 + \hat{\mathbf{y}}_1)$, which we call fabrication effect.

2. $\tfrac{1}{16}(\hat{\mathbf{w}}_0 + \hat{\mathbf{w}}_1)\,[\mathbf{L}_0\mathbf{\Delta}\hat{\mathbf{r}}\,\mathbf{A}_0\,(\hat{\mathbf{s}}+\mathbf{I})\ \mathbf{L}_1 + \mathbf{L}_1\mathbf{\Delta}\hat{\mathbf{r}}\,\mathbf{A}_0\,(\hat{\mathbf{s}}+\mathbf{I})\ \mathbf{L}_0]\ (\hat{\mathbf{y}}_0 + \hat{\mathbf{y}}_1)$, which we identify with the substitution effect.

It is important to note that estimates of the two effects may be influenced by how the matrices are obtained, particularly if they have obtained through RAS techniques. Although the sums of rows and columns will remain the same, in (7) the vectors $\mathbf{u}_1$ and $\mathbf{v}_1$ are generally exogenous information, the successive use of RAS will soften the changes of cells away from the more homogeneous approach, thereby missing information. However, both effects report on two important issues: which is the weight that actually has reduced inputs in technological change, and which part of this reduction is offset by increased inputs that play a greater role in the new technological conditions.

Finally, we must not forget that the three basic effects defined, intensity, technology and demand are *nxn* matrices resulting from the decomposition of $\Delta\mathbf{H} = (h_{ij})$ whose h_{ij} are the change in water consumed directly in the productive sector i to obtain inputs of this sector directly or indirectly used for the final demand of sector j. This makes that the h_{ij} can be added in rows, columns or for the entire economy. Their rows, such as its row i, tell us how it is allocated an increase of water consumed directly in the production of commodity i between different sectors through sales of i to each sector. And therefore, the sums of the rows of the effects will be the corresponding effects on direct water consumption of the sector.

Looking by columns, for example in column j, we have the changes in embodied water of the final demand j. Consequently, the sum by columns of the effects gives the corresponding effect on the embodied water in the final demand of the corresponding sector. As expected, for each of the basic effects, the sum of the effects on direct consumption from all sectors coincides with the sum of the effects on embodied water in all sectors, with this sum being the corresponding effect for the entire the economy.

3 Data

The starting point for the procedure consisted of the input-output tables provided by the Spanish Statistical Institute (NSI) for the year 1980 and from 1985 to the last year. From them we construct a time series of input-output tables complying with the EUKLEMS aggregates.

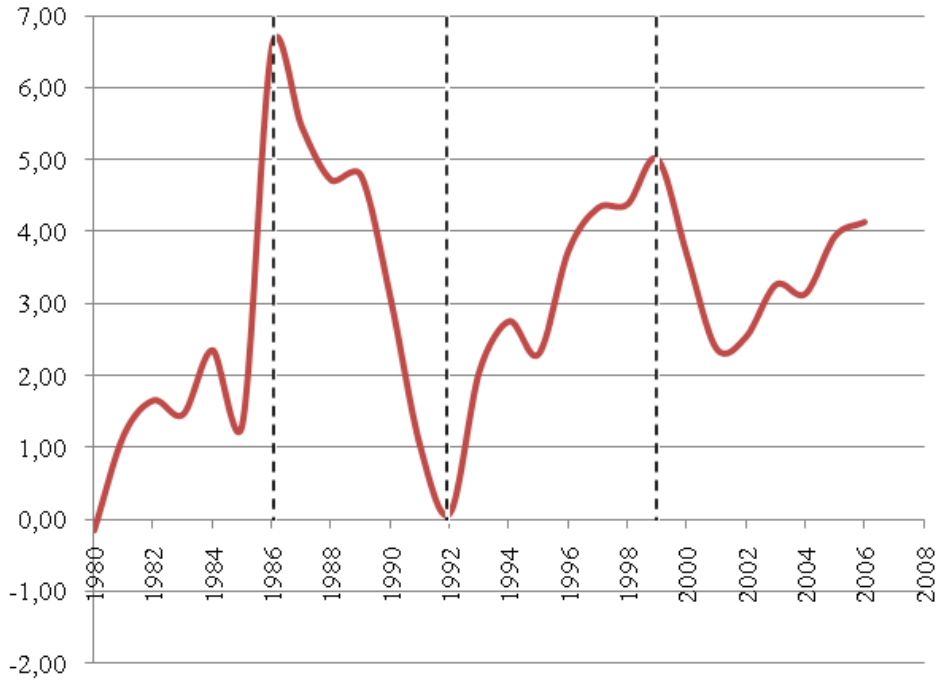
We distinguish among the periods 1980-1986, 1986-1992, 1992-1999 and 1999-2007 by simplicity, given the similarity of the periods (6, 6, 7 and 8 years respectively) and the changes among them observed in the production data. See Figure 1. Two of the sub-periods (1980-1986 and 1992-1999) were clearly expansionary, while the economy slowed in 1986-1992 and went down to the current crisis during the last one.

The data of (blue and green[3]) water consumption in the agricultural sector is obtained from the assumption of constant water intensities (in m^3 per ton of production) per crop, obtained from Chapagain and Hoekstra (2004) [1], which are multiplied by the production (in tones) of crops (FAO, 2011 [6]).

Regarding the industrial and services water, which represent much lower numbers, is obtained from 1997 to 2007 from the Satellite Water Accounts for Spain, of the Environmental Statistics from the National Statistic Institute (WSA, 2011 [13]). Before that year, constant intensities (per euro of production) are assumed from the year 1997. Hence the intensity effect of the first two periods is only relevant for the Agrarian sector

[3] The concept of green water refers to the part of water received as rain or snow that does not come to form part of the flow in watercourses. It consists, then, of the flow of precipitation that is not run-off. Blue water is associated with what hydrologists call contributions in the natural river regimen, hence with what traditionally has been called abstraction and ulterior consumption.

Figure 1: Value Added evolution for the Spanish economy (% of growth)



Source: Own elaboration.

4 Results

Importance of the sectors in the direct consumption water and embodied water contents

Table 1 shows the importance of each sector as a direct water consumer, and Table 2 the embodied water role by sector of the final demand of water (includes net exports).

In both tables we see for the period 1980-2007, and for each of its sub-periods, the average water (consumed directly or embodied respectively) per year, the sectoral shares and the average annual change in water consumption. As expected, the total figures for the whole economy are the same in both tables. The trend in water consumption (and therefore virtual water demand) was growing in the period 1980-2007, with an average annual increase of 976.1 hm^3, just over 1.3%, from an consumption of 62,291 hm^3 in 1980 to 88,645 hm^3 in 2007, representing an overall increase of 26,354 hm^3, a 42.31%. However there is a drop in the period 1986-1892, not very important and that was due to the decline in agricultural consumption (and consequently in the virtual water products using agricultural products as inputs).

As shown in Table 1, the main direct consumers are Agrarian S., hunting and forestry and Electricity, gas and water. They account for more than 98% of total consumption. For their consumption are also relevant the productive sectors Mining and quarrying, Chemical products, Basic metals and fabricated metal products, Pulp and paper, with an annual consumption of more than 100 hm^3, and Food industry and Textile and footwear with consumptions around 100 hm^3.

Table 2 shows a sectoral distribution very different from that shown in Table 1, which proves that the origin and destination sectors of water are very different. This justifies our double analysis for direct water consumed and embodied water consumed. The top three are Agrarian S., hunting and forestry, Food industry and Hotels and restaurants, the latter two are the destination of much of the water consumed in agricultural production. The negative figures of the first period in the early years should not mislead, since they result from the use of net exports in the model, even considering it, the average embodied water in the whole period of Agrarian S., hunting and forestry is above the 6,500 hm^3 and its average annual growth exceeds 1,500 hm^3. Other significant sectors due to its virtual water are Electricity, gas and water, Textile and footwear, Construction, and Other services. Evolution of embodied water in these relevant sectors is not the same, given the growth in the period 1980-2007 of Agrarian S., hunting and forestry, Electricity, gas and water, and Other services; the other four: Food industry, Textile and footwear, Construction, and Hotels and restaurants, reduce it.

Table 1: Direct water consumption and % of yearly sectoral change (hm^3).

		80-86			86-92			92-99			99-07			80-07	
	Average water consumption	%	Yearly change	Average yearly consumption	%	Yearly change	Average yearly consumption	%	Yearly change	Average yearly consumption	%	Yearly change	Average yearly consumption	%	Yearly change
Agrarian S., hunting and forestry	56.618,5	88,1%	779,6	62.036,6	87,2%	-419,2	60.320,5	84,6%	657,3	70.988,8	84,6%	1.630,7	63.040,2	85,8%	733,7
Mining and quarrying	160,2	0,2%	1,3	159,5	0,2%	3,5	151,1	0,2%	0,4	117,4	0,1%	-14,2	145,0	0,2%	-3,0
Electricity,gas and water	6.591,3	10,3%	314,0	7.914,8	11,1%	277,8	9.597,3	13,5%	159,9	11.489,5	13,7%	243,8	9.116,1	12,4%	245,2
Electrical, optical, office & computing	1,3	0,0%	0,1	2,0	0,0%	0,1	2,5	0,0%	0,1	2,9	0,0%	-0,2	2,2	0,0%	0,0
Chemical products	221,6	0,3%	5,7	291,8	0,4%	10,9	356,2	0,5%	13,2	385,1	0,5%	-28,7	320,6	0,4%	-1,4
Machinery	2,1	0,0%	0,0	2,5	0,0%	0,1	2,9	0,0%	0,2	3,6	0,0%	0,3	2,8	0,0%	0,1
Motor vehicles	4,5	0,0%	0,1	6,4	0,0%	0,2	8,1	0,0%	0,5	10,5	0,0%	-0,7	7,6	0,0%	0,0
Coke, refined petroleum & nuclear fuels	28,2	0,0%	-0,8	19,0	0,0%	-0,2	19,7	0,0%	0,7	18,7	0,0%	-2,1	21,1	0,0%	-0,7
Rubber and plastic	50,7	0,1%	1,9	70,3	0,1%	3,4	90,1	0,1%	3,7	87,0	0,1%	-10,5	76,0	0,1%	-1,0
Other non metallic minerals	27,6	0,0%	-0,4	31,7	0,0%	2,1	40,6	0,1%	1,2	38,0	0,0%	-0,9	34,9	0,0%	0,4
Basic metals & fabricated metal products	149,8	0,2%	-3,3	145,9	0,2%	-3,2	132,8	0,2%	5,1	170,0	0,2%	-4,8	150,5	0,2%	-1,6
Food industry	77,4	0,1%	1,7	95,6	0,1%	5,5	113,2	0,2%	0,6	143,2	0,2%	12,5	110,2	0,2%	5,5
Textile and footwear	93,2	0,1%	-1,0	96,6	0,1%	0,1	96,8	0,1%	2,7	102,2	0,1%	-9,3	97,6	0,1%	-2,2
Wood and wood products	25,4	0,0%	-0,4	32,6	0,0%	1,2	31,7	0,0%	0,8	25,3	0,0%	-4,4	28,6	0,0%	-0,9
Pulp and paper	131,8	0,2%	1,1	161,8	0,2%	7,3	212,1	0,3%	9,8	249,9	0,3%	-12,1	194,3	0,3%	0,8
Manufacturing	0,1	0,0%	0,0	0,1	0,0%	0,0	0,2	0,0%	0,0	0,1	0,0%	0,0	0,1	0,0%	0,0
Construction	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
Communications	1,0	0,0%	0,1	1,5	0,0%	0,1	2,5	0,0%	0,2	3,2	0,0%	-0,1	2,1	0,0%	0,1
Business activities	8,9	0,0%	0,2	13,5	0,0%	1,6	21,3	0,0%	0,9	25,0	0,0%	-0,8	17,9	0,0%	0,4
Wholesale, retail trade & recovery	6,3	0,0%	0,0	7,3	0,0%	0,4	9,3	0,0%	0,3	10,8	0,0%	-0,3	8,6	0,0%	0,1
Hotels and restaurants	16,6	0,0%	0,3	20,3	0,0%	1,1	25,9	0,0%	0,8	29,6	0,0%	-1,0	23,7	0,0%	0,2
Transport	3,0	0,0%	0,1	3,6	0,0%	0,2	4,8	0,0%	0,2	5,7	0,0%	-0,2	4,4	0,0%	0,1
Financial intermediation	0,2	0,0%	0,0	0,3	0,0%	0,0	0,3	0,0%	0,0	0,3	0,0%	0,0	0,3	0,0%	0,0
Real estate activities	0,7	0,0%	0,0	0,9	0,0%	0,0	1,2	0,0%	0,1	1,4	0,0%	0,0	1,1	0,0%	0,0
Other services	34,6	0,1%	0,7	39,9	0,1%	1,6	45,3	0,1%	1,3	51,7	0,1%	-1,8	43,6	0,1%	0,3
TOTAL	64.255,2	100,0%	1.101,0	71.154,3	100,0%	-105,2	71.286,3	100,0%	859,9	83.959,7	100,0%	1.795,0	73.449,6	100,0%	976,1

Source: Own elaboration

Table 2: Embodied water of the final demand and % of yearly sectoral change (hm^3).

		80-86			86-92			92-99			99-07			80-07	
	Embodied water	%	Yearly change	Embodied water	%	Yearly change	Embodied water	%	Yearly change	Embodied water	%	Yearly change	Embodied water	%	Yearly change
Agrarian S., hunting and forestry	-13.122,8	-20,4%	1.155,1	-2.472,9	-3,5%	174,2	10.435,0	14,6%	3.251,8	24.641,3	29,3%	1.300,3	6.540,8	8,9%	1.523,7
Mining and quarrying	81,9	0,1%	2,0	139,7	0,2%	13,6	-582,1	-0,8%	-231,7	-1.670,8	-2,0%	-75,6	-596,7	-0,8%	-79,0
Electricity,gas and water	1.233,4	1,9%	145,9	1.148,4	1,6%	-99,3	2.294,1	3,2%	441,0	4.687,1	5,6%	-86,0	2.512,8	3,4%	99,2
Electrical, optical, office & computing	10,0	0,0%	12,7	86,2	0,1%	4,5	209,3	0,3%	14,6	146,1	0,2%	-8,8	118,9	0,2%	5,0
Chemical products	-483,4	-0,8%	-12,9	-199,6	-0,3%	57,9	7,0	0,0%	31,7	97,9	0,1%	-0,7	-121,0	-0,2%	18,0
Machinery	184,5	0,3%	-17,8	151,7	0,2%	0,5	162,9	0,2%	3,0	175,9	0,2%	15,0	169,1	0,2%	1,4
Motor vehicles	910,5	1,4%	24,7	1.148,2	1,6%	7,0	1.087,9	1,5%	0,9	1.098,4	1,3%	4,8	1.065,0	1,4%	8,7
Coke, refined petroleum & nuclear fuels	-697,7	-1,1%	50,6	-424,2	-0,6%	-32,4	30,0	0,0%	162,1	496,7	0,6%	-7,9	-94,4	-0,1%	43,7
Rubber and plastic	-91,0	-0,1%	-12,4	-188,3	-0,3%	-28,2	-123,1	-0,2%	26,6	-7,5	0,0%	9,1	-96,2	-0,1%	0,6
Other non metallic minerals	-396,4	-0,6%	3,6	-423,4	-0,6%	-12,7	-150,1	-0,2%	64,5	171,9	0,2%	36,9	-170,1	-0,2%	25,7
Basic metals & fabricated metal products	146,0	0,2%	-22,2	40,4	0,1%	-27,3	-77,6	-0,1%	8,1	-92,3	-0,1%	-13,7	-6,0	0,0%	-12,9
Food industry	41.103,8	64,0%	258,3	39.904,7	56,1%	-29,4	27.837,0	39,0%	-2.693,6	24.303,2	28,9%	336,1	32.419,8	44,1%	-547,9
Textile and footwear	4.864,3	7,6%	-176,2	3.697,2	5,2%	-266,6	2.017,1	2,8%	-161,5	1.150,8	1,4%	-104,1	2.766,5	3,8%	-171,1
Wood and wood products	794,0	1,2%	28,3	1.028,4	1,4%	-41,4	114,3	0,2%	-163,1	-254,8	-0,3%	36,1	359,1	0,5%	-34,5
Pulp and paper	665,3	1,0%	9,4	572,8	0,8%	-28,6	438,8	0,6%	-8,1	423,2	0,5%	11,1	514,3	0,7%	-3,1
Manufacturing	298,4	0,5%	-52,2	156,3	0,2%	-7,4	562,8	0,8%	122,5	660,5	0,8%	-50,8	442,6	0,6%	3,4
Construction	3.310,8	5,2%	-144,9	3.321,5	4,7%	169,3	3.540,3	5,0%	-9,1	3.206,0	3,8%	-173,5	3.341,6	4,5%	-48,4
Communications	47,2	0,1%	5,3	64,8	0,1%	-1,4	89,3	0,1%	15,3	316,8	0,4%	35,4	141,9	0,2%	15,3
Business activities	158,7	0,2%	-45,3	91,4	0,1%	13,7	129,7	0,2%	20,3	186,2	0,2%	1,3	144,4	0,2%	-1,4
Wholesale, retail trade & recovery	2.448,6	3,8%	-1,1	2.372,9	3,3%	64,4	3.157,8	4,4%	64,6	4.053,9	4,8%	190,3	3.091,3	4,2%	87,2
Hotels and restaurants	14.076,6	21,9%	61,8	13.831,5	19,4%	54,5	13.522,8	19,0%	28,5	12.182,6	14,5%	-269,0	13.317,4	18,1%	-46,5
Transport	585,5	0,9%	3,4	508,2	0,7%	-6,1	558,9	0,8%	10,0	440,8	0,5%	-23,2	518,5	0,7%	-4,9
Financial intermediation	-1,4	0,0%	-1,4	-7,1	0,0%	-1,1	1,0	0,0%	4,1	161,4	0,2%	29,1	46,2	0,1%	9,1
Real estate activities	322,3	0,5%	23,1	372,9	0,5%	-10,9	493,7	0,7%	36,6	524,2	0,6%	-9,4	437,8	0,6%	9,4
Other services	7.806,1	12,1%	-196,4	6.232,7	8,8%	-71,9	5.529,7	7,8%	-179,2	6.860,0	8,2%	612,2	6.586,0	9,0%	75,3
TOTAL	64.255,2	100,0%	1.101,0	71.154,3	100,0%	-105,2	71.286,3	100,0%	859,9	83.959,7	100,0%	1.795,0	73.449,6	100,0%	976,1

Source: Own elaboration. Negative figures, which we mainly find in the agrarian contents from the year 1980 to 1986, are mainly explained by net water exports used in the model.

Average effects of the water changes in the period

The different sectoral effects and periods allow more detailed analysis of the reasons for these changes, so we now turn to its estimation and analysis. Tables 3 and 4 show the total water increase in the period 1980-2006, which was of 26,354 hm^3, distributed by sectors and by the three effects we have defined, intensity, technological and demand, showing also the internal, forward, backward, saving inputs and substitution effects as complementary information of the technological effect. In Table 3, the sectors that appear are those who have consumed water directly for production, reporting the effects of the factors that drove the changes. On the other hand, Table 4 shows the same increase of 26,354 hm^3 distributed among the sectors that incorporate it as virtual water, measuring the effect of the factors that have generated the corresponding increase or decrease of the water embodied water of the final demand of the sector.In the last row of both tables we observe the importance of the demand effect[4]. This by itself would produce an increase of almost three times more, 76,654 hm^3. Economic growth in the Spanish economy has generated greater income and this has been an extremely strong increase in final demand. As shown in Duarte and Sanchez Chóliz (2011) [4], the average increase in value over this period is above the 3% annual rate, which is much higher than the increase in water consumption.

The increase via demand is largely offset, 2/3 approximately, by the technology and intensity effects that are due primarily to changes in agricultural crops. The modernization of agriculture and the increase of intensive agriculture has led to productions that may be more intensive water per ton of product, but which are not in final production per euro, as in the change of cultivation of cereals to growing vegetables. This has meant that the intensity effect is negative, more than 11,000 hm^3. Similar reasons, saving of inputs per unit of final production (and therefore virtual water saving), have led to the negative and very high technological, 39,081 hm^3 of saving, more than the total increase in consumption.

To better understand the significance of this technological change, we also look at the internal and forward effects of Table 3. It stands out the small importance of the technological effect in the savings of agriculture towards its final demand, 1,483 hm^3 compared to the 39,081 hm^3 of the total technological effect. Moreover, the forward effect shows that the technological savings were primarily in water consumed in agriculture which was incorporated as virtual water in agricultural input in other sectors, of 40,326 hm^3. This effect, as it will be further confirmed with the backward effect when looking at the embodied water changes, implies water savings reflected in the water finally consumed via Food industry (especially of products for feed) and Hotels and restaurants, and particularly. Moreover, looking to the backward effect in Table 4, what we see is that it is primarily the reduction of agricultural input (used more efficiently) by the Food industry and Hotels and restaurants which generates these savings, helping also the reductions of agricultural inputs by Textile and footwear and Other services.

A complementary and very similar information is obtained from the fabrication and substitution effects, which contrast the reduction of inputs and the relevance of input. Comparing total values we may claim that the saving effect is more powerful (94,573 hm^3) than the relevance of inputs effect (substitution, of 55,601 hm^3). This is what makes that the technological effect, which includes both aspects, indicates a saving of water.

If we look at the fabrication effect in Table 3, we see that the savings are clearly related to water consumption in agriculture, leading to reductions in agricultural inputs used by other sectors, see saving input effects in Table 4, mainly in Food industry, Hotels and restaurants and Other services. Note also that the virtual water reduction of the inputs used in Agrarian S., hunting and forestry is not significant.

Moreover, looking at the substitution effect, the weight of 98.4% of Agrarian S., hunting and forestry in Table 3 again confirms that water flows are associated above all with agrarian goods, as we saw earlier. Moreover, this effect in Table 4 confirms that the sectors for which agricultural products as vegetables, fruits, corn, feed for cattle,... are increasingly important are the Food industry, hotels and restaurants and Other services.The use of tables similar to Tables 3 and 4 for each period the previous analysis helps to refine and add a temporal view, for those interested these tables can be found in the Annex (Tables , 10, 11, 12, 13, 14, 15, 16 and 17). Here, for brevity we will focus on Table 5, giving the totals for sub-periods of each of the effects, their percentage distribution in the period and their percentage in the total change of water consumption in the economy between 1980 and 2007.

The evolution of the total increase shows that the growth of water consumption has been constant or nearly constant. The 54.5% of the total increase corresponds to the last period, 1999-2007, and there is instead a reduction in the years 1986-1992. This is worrying, especially when it is observed that the intensity effect is also increased in 1999-2007, compared to the sharp drop suffered in 1986-1992. This means that Spanish agricultural crops are changing again, but this time towards more water-intensive crops per euro produced, although they are crops requiring less inputs, as shown by the negative value of the fabrication effect.

[4] In interpreting the demand effect it should not be forgotten the strong growth of the Spanish population during this period. This growth and changing consumption patterns are the two main reasons behind the strong demand effects.

Table 3: Effects of the water consumption in the period 1980-2006 (hm^3).

	Intensity effect		Technological effect		Internal effect		Forward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%		%		%		%
Agrarian S., hunting and forestry	-5,752.1	51.3	-41,808.4	107.0	-1,482.7	144.8	-40,325.6	106.0	-96,394.8	101.9	54,685.7	98.4	67,369.5	87.9	19,809.0	75.2
Mining and quarrying	-104.1	0.9	511.3	-1.3	-50.5	4.9	561.8	-1.5	485.9	-0.5	24.0	0.0	-488.9	-0.6	-81.8	-0.3
Electricity,gas and water	-4,546.1	40.5	2,223.3	-5.7	483.6	-47.2	1,739.7	-4.6	1,610.0	-1.7	621.8	1.1	8,943.1	11.7	6,620.3	25.1
Electrical, optical, office & computing	-1.9	0.0	0.7	0.0	0.1	0.0	0.6	0.0	0.6	0.0	0.1	0.0	1.9	0.0	0.7	0.0
Chemical products	-313.4	2.8	-3.4	0.0	5.2	-0.5	-8.6	0.0	-91.4	0.1	89.8	0.2	279.5	0.4	-37.3	-0.1
Machinery	0.7	0.0	0.7	0.0	-0.1	0.0	0.8	0.0	0.6	0.0	0.1	0.0	2.5	0.0	3.8	0.0
Motor vehicles	-8.4	0.1	2.7	0.0	1.7	-0.2	0.9	0.0	2.5	0.0	0.2	0.0	5.7	0.0	0.0	0.0
Coke, refined petroleum & nuclear fuels	-32.6	0.3	-91.6	0.2	19.7	-1.9	-111.3	0.3	-139.7	0.1	48.4	0.1	106.3	0.1	-17.9	-0.1
Rubber and plastic	-113.7	1.0	36.0	-0.1	-1.8	0.2	37.8	-0.1	24.2	0.0	12.5	0.0	51.1	0.1	-26.5	-0.1
Other non metallic minerals	-26.8	0.2	-14.9	0.0	1.2	-0.1	-16.1	0.0	-11.1	0.0	-4.0	0.0	52.6	0.1	11.0	0.0
Basic metals & fabricated metal products	-110.7	1.0	-2.5	0.0	-2.4	0.2	0.0	0.0	-4.0	0.0	2.2	0.0	71.3	0.1	-41.9	-0.2
Food industry	88.7	-0.8	-2.7	0.0	7.0	-0.7	-9.7	0.0	-43.7	0.0	41.0	0.1	61.3	0.1	147.3	0.6
Textile and footwear	-36.0	0.3	13.1	0.0	1.2	-0.1	11.9	0.0	1.5	0.0	11.5	0.0	-37.6	0.0	-60.6	-0.2
Wood and wood products	-39.4	0.4	13.6	0.0	-1.0	0.1	14.7	0.0	9.7	0.0	3.2	0.0	1.0	0.0	-24.8	-0.1
Pulp and paper	-140.2	1.2	13.8	0.0	-9.0	0.9	22.8	-0.1	-41.5	0.0	56.2	0.1	148.6	0.2	22.2	0.1
Manufacturing	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
Construction	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
Communications	-3.2	0.0	1.5	0.0	0.1	0.0	1.3	0.0	0.9	0.0	0.5	0.0	3.2	0.0	1.5	0.0
Business activities	-20.4	0.2	17.0	0.0	0.2	0.0	16.8	0.0	12.1	0.0	4.8	0.0	13.6	0.0	10.2	0.0
Wholesale, retail trade & recovery	-6.2	0.1	2.4	0.0	0.3	0.0	2.1	0.0	1.7	0.0	0.7	0.0	5.5	0.0	1.7	0.0
Hotels and restaurants	-12.8	0.1	-0.7	0.0	0.0	0.0	-0.7	0.0	-1.2	0.0	0.5	0.0	20.2	0.0	6.7	0.0
Transport	-3.0	0.0	2.5	0.0	0.4	0.0	2.2	0.0	1.6	0.0	0.9	0.0	1.9	0.0	1.4	0.0
Financial intermediation	-0.2	0.0	-0.2	0.0	0.0	0.0	-0.1	0.0	-0.3	0.0	0.2	0.0	0.4	0.0	0.0	0.0
Real estate activities	-0.8	0.0	0.6	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.1	0.0	0.6	0.0	0.4	0.0
Other services	-36.3	0.3	4.3	0.0	2.7	-0.3	1.6	0.0	3.2	0.0	1.1	0.0	40.9	0.1	8.9	0.0
TOTAL	-11,219.0	100.0	-39,081.0	100.0	-1,024.3	100.0	-3,8056.7	100.0	-94,572.8	100.0	55,601.4	100.0	76,654.4	100.0	26,354.3	100.0
% del Δ total of consumption		-42.6		-148.3		-3.9		-144.4		-358.9		211.0		290.9		100.0

Source: Own elaboration.

Table 4: Effects of the embodied water consumption in the period 1980-2006 (hm^3).

	Intensity effect		Technological effect		Internal effect		Backward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%		%		%		
Agrarian, hunting and forestry	10,600.1	-94.5	-1,493.6	3.8	-1,482.7	144.8	-10.9	0.0	-1,507.9	1.6	78.2	0.1	32,034.0	41.8	41,140.4	156.1
Mining and quarrying	800.3	-7.1	7.3	0.0	-50.5	4.9	57.8	-0.2	49.2	-0.1	-5.7	0.0	-2,940.6	-3.8	-2,133.0	-8.1
Electricity, gas and water	-1,955.0	17.4	490.8	-1.3	483.6	-47.2	7.1	0.0	266.4	-0.3	-213.8	-0.4	4,142.7	5.4	2,678.5	10.2
Electrical, optical & computing	-24.7	0.2	-32.5	0.1	0.1	0.0	-32.5	0.1	-97.9	0.1	56.7	0.1	192.2	0.3	135.0	0.5
Chemical products	62.9	-0.6	80.9	-0.2	5.2	-0.5	75.8	-0.2	87.9	-0.1	28.6	0.1	343.1	0.4	487.0	1.8
Machinery	-48.1	0.4	-25.3	0.1	-0.1	0.0	-25.2	0.1	-104.1	0.1	32.7	0.1	110.5	0.1	37.2	0.1
Motor vehicles	-418.1	3.7	-220.1	0.6	1.7	-0.2	-221.8	0.6	-593.2	0.6	338.0	0.6	872.6	1.1	234.4	0.9
Coke, petroleum & nuclear fuels	-130.5	1.2	-269.1	0.7	19.7	-1.9	-288.8	0.8	1,200.2	-1.3	-1,397.8	-2.5	1,579.6	2.1	1,180.0	4.5
Rubber and plastic	60.8	-0.5	107.2	-0.3	-1.8	0.2	109.0	-0.3	87.0	-0.1	-15.6	0.0	-153.1	-0.2	15.0	0.1
Other non metallic minerals	6.2	-0.1	49.6	-0.1	1.2	-0.1	48.3	-0.1	65.9	-0.1	-3.9	0.0	637.0	0.8	692.7	2.6
Basic metals & metal products	50.8	-0.5	-18.6	0.0	-2.4	0.2	-16.2	0.0	10.8	0.0	-23.7	0.0	-381.7	-0.5	-349.5	-1.3
Food industry	-12,980.2	115.7	-20,120.8	51.5	7.0	-0.7	-20,127.8	52.9	-49,901.0	52.8	31,209.2	56.1	18,307.6	23.9	-14,793.4	-56.1
Textile and footwear	-1,105.5	9.9	-2,420.4	6.2	1.2	-0.1	-2,421.6	6.4	-3,438.5	3.6	1,202.8	2.2	-1,094.5	-1.4	-4,620.5	-17.5
Wood and wood products	-440.1	3.9	-104.1	0.3	-1.0	0.1	-103.1	0.3	-241.5	0.3	114.4	0.2	-386.9	-0.5	-931.1	-3.5
Pulp and paper	-185.4	1.7	-328.5	0.8	-9.0	0.9	-319.5	0.8	-551.7	0.6	79.5	0.1	430.6	0.6	-83.3	-0.3
Manufacturing	103.5	-0.9	-275.5	0.7	0.0	0.0	-275.5	0.7	-508.5	0.5	69.4	0.1	264.7	0.3	92.7	0.4
Construction	-831.2	7.4	-2,471.5	6.3	0.0	0.0	-2,471.5	6.5	-2,756.9	2.9	625.0	1.1	1,996.5	2.6	-1,306.1	-5.0
Communications	-71.5	0.6	147.1	-0.4	0.1	0.0	147.0	-0.4	-90.5	0.1	174.1	0.3	337.2	0.4	412.8	1.6
Business activities	-21.5	0.2	50.3	-0.1	0.2	0.0	50.1	-0.1	-148.2	0.2	71.9	0.1	-65.3	-0.1	-36.5	-0.1
Wholesale, retail & recovery	130.8	-1.2	139.7	-0.4	0.3	0.0	139.5	-0.4	-2,423.2	2.6	43.5	0.1	2,084.4	2.7	2,355.0	8.9
Hotels and restaurants	-2,405.0	21.4	-10,227.1	26.2	0.0	0.0	-10,227.1	26.9	-25,648.1	27.1	17,543.1	31.6	11,377.3	14.8	-1,254.8	-4.8
Transport	-126.5	1.1	-81.9	0.2	0.4	0.0	-82.3	0.2	-740.3	0.8	584.5	1.1	76.4	0.1	-131.9	-0.5
Financial intermediation	-25.9	0.2	36.4	-0.1	0.0	0.0	36.5	-0.1	-78.7	0.1	19.7	0.0	235.7	0.3	246.2	0.9
Real estate activities	-73.5	0.7	96.5	-0.2	0.0	0.0	96.5	-0.3	-51.3	0.1	72.4	0.1	231.3	0.3	254.3	1.0
Other services	-2,191.8	19.5	-2,198.0	5.6	2.7	-0.3	-2,200.6	5.8	-7,458.8	7.9	4,918.1	8.8	6,423.2	8.4	2,033.3	7.7
TOTAL	-11,219.0	100.0	-39,081.0	100.0	-1,024.3	100.0	-38,056.7	100.0	-94,572.8	100.0	55,601.4	100.0	76,654.4	100.0	26,354.3	100.0
% del Δ total of consumption		-42.6		-148.3		-3.9		-144.4		-358.9		211.0		290.9		100.0

Source: Own elaboration.

Table 5: Total effects and percentages by subperiods.

	Intensity	% %	Technological	%	Internal	%	Forward	&	Backward	%	Input saving	%	Substitution	%	Demand	%	Δ W	%
1980-2007	-11,219.0	-42.6	-39,081.0	-148.3	-1,024.3	-3.9	-38,056.7	-144.4	-38,056.7	-144.4	-94,572.8	-358.9	55,601.4	211.0	76,654.4	290.9	26,354.3	100.0
% Δ W del 80-07	-42.6		-148.3		-3.9		-144.4		-144.4		-358.9		211.0		290.9		100.0	
1980-1986	-4,696.2	-71.1	-4,964.9	-75.2	153.7	2.3	-5,118.7	-77.5	-5,118.7	-77.5	-20,028.1	-303.2	15,060.0	228.0	16,267.3	246.2	6,606.2	100.0
% Δ W del 80-07	-17.8		-18.8		0.6		-19.4		-19.4		-76.0		57.1		61.7		25.1	
1986-1992	-15,144.7	2,398.9	-7,119.8	1,127.8	66.4	-10.5	-7,186.2	1,138.3	-7,186.2	1,138.3	-20,967.3	3,321.3	13,842.7	-2,192.7	21,633.1	-3,426.7	-631.3	100.0
% Δ W del 80-07	-57.5		-27.0		0.3		-27.3		-27.3		-79.6		52.5		82.1		-2.4	
1992-1999	-2,608.4	-43.3	-12,156.3	-202.0	-701.1	-11.6	-11,455.2	-190.3	-11,455.2	-190.3	-14,530.6	-241.4	2,506.3	41.6	20,784.0	345.3	6,019.2	100.0
% Δ W del 80-07	-9.9		-46.1		-2.7		-43.5		-43.5		-55.1		9.5		78.9		22.8	
1999-2007	11,230.3	78.2	-14,840.0	-103.3	-543.3	-3.8	-14,296.7	-99.6	-14,296.7	-99.6	-39,046.9	-271.9	24,192.4	168.5	17,969.9	125.1	14,360.2	100.0
% Δ W del 80-07	42.6		-56.3		-2.1		-54.2		-54.2		-148.2		91.8		68.2		54.5	

Source: Own elaboration.

The demand effect, which has been central to increasing consumption between 1980 and 2007, has maintained throughout all the years, varying weight in different periods between 61.7% and 82.1% of the average annual savings. Do not forget that from 1980 to 2007 the water demand change was almost three times the total change of water consumption. In other words, if the increase of 26,354 hm^3, compared to the current population of Spain, 46 million people in 2011, implies a rise of 573 m^3 per person (more than 21 m^3 each year), only considering the demand change it would have implied 1,666 m^3 more per person (more than 61 m^3 each year). After this first approximation, we consider interesting to examine those per capita demand and total changes by period (constructed from changes year by year, and hence the population in each moment of time), which is what we present in Tables 6 and 7. Interestingly, the reduction of water consumption in the period 1986-1991 does not come from the demand effect examined in per capita terms (whose change is positive), but from all the others. Looking by sectors, in general the demand changes pointed out the direction of the big total changes, but the per capita demand changes were almost always positive, when especially in the industrial sectors there were total reductions in the last periods. Clear negative demand effects though come from the sectors of Mining and quarrying, and Textile and footwear, whose direct water consumption was notably reduced in the last two periods.

Table 6: Per capita changes, Demand effect by subperiods.

Year >>	1980-1985		1986-1991		1992-1998		1999-2007	
Classifications	**Direct**	**Embodied**	**Direct**	**Embodied**	**Direct**	**Embodied**	**Direct**	**Embodied**
Agrarian S., hunt and forest	65.61	26.43	85.85	0.57	58.61	74.78	47.03	14.83
Mining and quarrying	0.20	-0.07	0.23	0.40	-0.89	-5.56	-1.00	-4.34
Electricity,gas and water	5.12	3.51	5.07	-2.41	15.94	12.24	6.32	1.46
Chemical products	0.01	-0.70	0.41	1.14	0.35	0.76	0.24	0.07
Coke, petroleum and nuclear	0.24	1.89	0.00	-0.67	0.18	4.23	0.01	0.37
Rubber and plastic	0.00	-0.56	0.02	-0.92	0.09	0.43	0.06	0.21
Other non metallic minerals	0.01	0.11	0.06	-0.51	0.07	1.50	0.05	0.93
Basic metals and metal prod.	-0.01	-0.53	0.11	-0.72	0.11	0.13	0.05	-0.38
Food industry	0.05	29.95	0.14	61.05	-0.05	-30.14	0.09	16.41
Textile and footwear	0.02	0.61	-0.01	-0.89	-0.05	-1.68	-0.07	-1.65
Wood and wood products	0.02	1.60	0.02	-0.06	-0.06	-3.51	0.02	0.71
Pulp and paper	0.05	0.88	0.15	0.16	0.13	0.25	0.19	0.36
Other services	0.01	3.28	0.04	6.31	0.02	2.51	0.07	10.32
Rest of the accounts	0.00	4.91	0.07	28.69	0.07	18.59	0.06	14
Total	**71**	**71**	**92**	**92**	**75**	**75**	**53**	**53**

Source: Own elaboration.

Table 7: Per capita changes, Total effect by subperiods.

Year >>	1980-1985		1986-1991		1992-1998		1999-2007	
Classifications	**Direct**	**Embodied**	**Direct**	**Embodied**	**Direct**	**Embodied**	**Direct**	**Embodied**
Agrarian S., hunt and forest	20.51	30.39	-10.72	4.45	16.50	81.61	38.55	30.74
Mining and quarrying	0.03	0.05	0.09	0.35	0.01	-5.82	-0.34	-1.79
Electricity,gas and water	8.26	3.84	7.10	-2.54	4.01	11.07	5.76	-2.03
Chemical products	0.15	-0.34	0.28	1.48	0.33	0.80	-0.68	-0.02
Coke, petroleum and nuclear	-0.02	1.33	0.00	-0.83	0.02	4.07	-0.05	-0.19
Rubber and plastic	0.05	-0.33	0.09	-0.72	0.09	0.67	-0.25	0.21
Other non metallic minerals	-0.01	0.09	0.05	-0.32	0.03	1.62	-0.02	0.87
Basic metals and metal prod.	-0.09	-0.58	-0.08	-0.70	0.13	0.20	-0.11	-0.32
Food industry	0.05	6.80	0.14	-0.75	0.02	-67.61	0.29	7.95
Textile and footwear	-0.03	-4.64	0.00	-6.82	0.07	-4.05	-0.22	-2.46
Wood and wood products	-0.01	0.75	0.03	-1.06	0.02	-4.09	-0.10	0.85
Pulp and paper	0.03	0.25	0.19	-0.73	0.25	-0.20	-0.29	0.26
Other services	0.02	-5.17	0.04	-1.84	0.03	-4.50	-0.04	14.47
Rest of the accounts	0.02	-3.47	0.10	7.33	0.08	7.81	-0.07	-6.12
Total	**29**	**29**	**-3**	**-3**	**22**	**22**	**42**	**42**
Total per capita water consumption of the period	**1,691**		**1,819**		**1,789**		**1,985**	

Source: Own elaboration.

Also the technological saving is maintained over the four periods, increasing in volume over the four periods. This is seen in both figures of the technological change as in the forward and backward effects. Notwithstanding the differences between the beginning and end clearly manifest in the internal effect, positive in the first two periods and negative in the other two.

Inspection of the Agrarian production and water consumption changes

As we have seen above, the importance of the agrarian sector is marked in explaining the direct water consumptions and changes, and also very high as the main factor of embodied water yearly variations. In this sense a further inspection of the water consumption increases is presented in Table 8, relying on structural decomposition of the production of each crop, production which is the product of acreage and productivity (output per unit area). In the table we show the results as a percentage of total crop production. They are presented for the total changes for the period 1980-2007 and for each of the four sub-periods analyzed. For 1980-2007 it is also the average weight of each crop represented in the total water consumption. There are only shown, for clarity, (39) crops that have more percentage

weight in water consumption, which together account for 94.8% of the total. Remember, finally, that since each crop has a fixed intensity in our calculations, the percentage increase in production coincided with the % increase in water consumption in the crop production.

As can be seen in Table 8, the highest average contribution to the total water consumption of the crops comes from olives, barley, grapes, wheat and almonds. They are followed by gramineous and leguminous, chilies, corn, and grasses. They all represent at least 2% of water consumption, and 9 represent approximately 74% of total consumption, which make their evolution as highly characteristic of the overall development of the economy. Of these 9 crops, 7 of them increased water consumption, namely: olives, barley, wheat, gramineous and leguminous, chilies and pepper, corn, and grasses, while 2 of them reduced it: grapes and almonds. Without doubt, in the increase of barley, wheat and grasses has strongly affected the agricultural policy of the European Union. These increases and reductions in production and consumption of water, dominating the increases, are merely a reflection of what was already said, the Spanish economy grew during the period 1980-2007 forced mainly by consumption demand, changing weight or proportions of their crops to less water-intensive crops per euro. These changes were not static, and as we shall see, there are different behaviors at the beginning of the period and at the end. Let's see some more detail how they have evolved in detail each of these 9 important crops.

In the cases of olives and gramineous and leguminous, their average increases are very high and are due to increase of productivity (production per area harvested) and especially in the area harvested.
By contrast, in barley, wheat, pepper and corn, three crops which also increased water consumption, the determining factor was the improvement in productivity, which required higher amounts of water, existing in the four a decrease in surface cultivated during the period, especially in wheat. Finally, in the case of grass, the fall in productivity was offset by a greater surface used, which resulted in increased water consumption.

Looking at the most relevant crops which reduced their production and therefore consumption of water, we see that productivity grows in the case of grapes, but drops the surface (it was probably also influenced by the common European agricultural policy), leading to lower final production. Finally in almonds the fall of productivity was not offset by an increase in the surface under cultivation.

Turning to the analysis by periods, we see that the evolution of olives is irregular in the first two periods (in one there is a fall in productivity and in another the surface), but its production is consolidated in recent years, increasing both productivity and the surface in the final two periods.
Barley is a crop that initially reduced production, but in the last two periods greatly increases its productivity and even in the latter it also grows in surface, leading to large increases in production, which explains its growth from 1980 to 2007. Wheat has a very similar evolution, initial declines in output with losses in productivity which suffers stronger growth in the final two periods, especially in the last, leading to higher yields even with reductions in area cultivated between 1999 and 2007.
Chilies and pepper cultivation has increasing production in the four periods primarily due to higher productivity improvements, offsetting reductions in area detected in the last three periods. Similarly, corn, improved productivity in all periods, but tends to drop his acreage over the period.
In the case of grasses there has been a steady increase in acreage, probably favored by the European agricultural policy, but productivity fell in the intermediate years of the period, but were to be offset by the rise of the last period.

It remains to discuss the products that lost production from 1980 to 2007. With respect to grapes, we see by periods a clear tendency to improve productivity with a tendency to decrease or maintain the surface which overcomes productivity. European agricultural policy has encouraged the reduction of areas, as it has happened. On the other hand, in the case of almonds, productivity has fallen except in the period 1986-1992, while the surface has changed little, dominating again the evolution.

In general, the increase in water consumption in agriculture was incorporated in goods sold to other sectors, especially for feed, which is one of the activities that increased its presence throughout the period (especially considering the switch from livestock nutrition from agricultural goods directly used to a prepared compound-feed diet). Also gramineous, grasses...and a certain move towards more water intense crops (from potatoes, cabbages, beans,..., to fruits (oranges, tangerines, peach...), industrial (linseed, fibers...).

Table 8: Average productivity, area harvested and production variation in %, and % water consumption for most relevant crops.

	1980-2007				1980-1986			1986-1992			1992-1999			1999-2007		
Classification	Productivity	Surface	Production	Water	Productivity	Surface	Production	Productivity	Surface	Production	Productivity	Surface	Production	Productivity	Surface	Production
Olives	27,5%	113,6%	172,3%	17,8%	-36,4%	78,4%	13,4%	25,0%	-0,6%	24,3%	1,5%	7,3%	8,9%	58,1%	12,3%	77,5%
Alfalfa	14,9%	-26,2%	-15,3%	0,5%	1,0%	-7,7%	-6,7%	2,9%	-5,0%	-2,2%	15,7%	-20,7%	-8,3%	-4,5%	6,1%	1,3%
Locust beans	-13,6%	-67,0%	-71,5%	1,3%	-12,6%	-12,6%	-23,6%	0,4%	-12,3%	-11,9%	-7,4%	-23,5%	-29,2%	6,3%	-43,8%	-40,3%
Seed cotton	-35,5%	4,1%	-32,9%	0,5%	8,2%	28,6%	39,2%	-15,1%	-6,4%	-20,5%	28,8%	43,9%	85,4%	-45,5%	-39,9%	-67,3%
Almonds in shell	-23,8%	9,3%	-16,7%	7,2%	-9,4%	8,5%	-1,7%	22,8%	3,7%	27,3%	-8,0%	7,6%	-1,0%	-25,5%	-9,7%	-32,8%
Paddy	12,5%	48,5%	67,0%	1,3%	-0,1%	14,7%	14,6%	2,0%	9,2%	11,3%	16,9%	30,8%	52,9%	-5,5%	-9,4%	-14,4%
Hazelnuts	14,1%	-52,7%	-46,0%	0,4%	-32,2%	2,1%	-30,8%	60,5%	-20,4%	27,7%	8,5%	-3,1%	5,2%	-3,3%	-40,0%	-42,0%
Oats	66,0%	16,0%	92,5%	1,5%	-25,9%	-14,1%	-36,3%	-9,4%	-20,2%	-27,7%	29,9%	30,5%	69,5%	90,1%	29,8%	146,7%
Chestnuts*	-60,0%	54,3%	-38,3%	0,2%	-4,8%	13,4%	8,0%	-17,3%	0,0%	-17,3%	-51,2%	0,0%	-51,2%	4,2%	36,0%	41,8%
Barley	52,0%	-9,7%	37,2%	13,3%	-29,7%	21,4%	-14,6%	-13,3%	-5,3%	-17,8%	61,2%	-24,5%	21,8%	54,6%	3,9%	60,7%
Rye	78,8%	-48,5%	-7,9%	1,1%	-24,0%	1,9%	-22,5%	16,1%	-18,8%	-5,7%	55,7%	-31,9%	6,0%	30,1%	-8,6%	19,0%
Cherries	-47,3%	80,2%	-5,0%	0,3%	-51,4%	64,9%	-19,8%	19,6%	16,7%	39,6%	8,7%	12,0%	21,8%	-16,6%	-16,5%	-30,3%
chilies, pepper (Green)	136,7%	-19,0%	91,8%	4,6%	24,3%	1,1%	25,6%	12,3%	-2,9%	9,0%	42,9%	-14,4%	22,3%	18,6%	-3,5%	14,4%
Dried beans	112,1%	-93,5%	-86,3%	0,3%	19,5%	-20,5%	-5,0%	-19,0%	-42,0%	-53,0%	85,3%	-66,7%	-38,2%	18,2%	-58,0%	-50,3%
Chickpeas	45,5%	-66,0%	-50,5%	0,3%	-5,1%	0,3%	-4,8%	7,0%	-51,3%	-47,9%	-46,3%	86,8%	0,3%	166,8%	-62,7%	-0,6%
Gramin. & Legum.*	190,9%	5997,6%	17637,0%	5,3%	98,1%	5778,0%	11543,7%	-19,5%	2,3%	-17,6%	80,7%	2,2%	84,7%	1,0%	-0,8%	0,1%
Grasses	-26,1%	66,1%	22,7%	2,3%	1,6%	2,5%	4,2%	-6,3%	38,1%	29,4%	-32,5%	14,0%	-23,1%	14,9%	3,0%	18,3%
Dried peas	22,4%	2634,6%	3246,7%	0,2%	23,4%	-15,4%	4,4%	4,2%	61,4%	68,1%	-4,9%	498,6%	469,0%	0,2%	234,6%	235,2%
Haba, beans dried	26,8%	-69,6%	-61,5%	0,2%	-5,4%	-40,6%	-43,8%	13,3%	-48,0%	-41,1%	-41,5%	-55,2%	-73,8%	102,4%	119,4%	344,0%
Forage Legum	-54,1%	-58,1%	-80,8%	1,9%	-53,4%	-34,2%	-69,4%	-10,3%	-5,0%	-14,8%	6,6%	-35,8%	-31,6%	3,1%	4,4%	7,7%
NCP pulses	0,7%	-83,7%	-83,6%	0,4%	-23,2%	-31,7%	-47,6%	-30,7%	-63,0%	-74,3%	-43,4%	443,1%	207,6%	234,2%	-88,2%	-60,4%
Lentils	6,8%	-75,8%	-74,2%	0,4%	-23,9%	-4,7%	-27,5%	-47,8%	-50,2%	-74,0%	32,7%	-36,7%	-16,0%	102,2%	-19,5%	62,9%
Corn	96,5%	-20,6%	56,1%	3,2%	28,4%	15,3%	48,0%	7,4%	-25,0%	-19,5%	35,1%	1,2%	36,7%	5,5%	-9,2%	-4,2%
Forage maize	12,6%	-13,2%	-2,3%	0,8%	-1,4%	5,9%	4,5%	8,0%	6,2%	14,7%	10,6%	-28,4%	-20,8%	-4,4%	7,7%	2,9%
Apples	24,9%	-38,0%	-22,5%	0,6%	-14,2%	2,4%	-12,2%	42,4%	-5,9%	34,0%	5,3%	-14,3%	-9,8%	-2,9%	-24,8%	-27,0%
Peach, nectarine	74,3%	81,1%	215,7%	0,8%	5,8%	34,2%	42,0%	52,0%	22,6%	86,4%	-0,1%	-3,9%	-4,0%	8,5%	14,6%	24,3%
Forage Turnips	49,7%	-97,8%	-96,7%	0,2%	1,6%	-21,7%	-20,4%	-10,6%	-30,6%	-38,0%	45,0%	-84,9%	-78,1%	13,6%	-73,0%	-69,3%
Oranges	28,3%	24,9%	60,2%	1,3%	19,8%	1,5%	21,5%	24,6%	13,5%	41,4%	-9,0%	0,5%	-8,5%	-5,6%	7,9%	1,8%
Potatoes	-25,6%	-41,9%	-56,8%	1,3%	-11,1%	0,5%	-10,7%	20,3%	-16,0%	1,1%	-18,1%	-20,6%	-35,0%	-15,1%	-13,3%	-26,4%
Ryegrass	6,9%	-50,7%	-47,3%	0,4%	11,5%	-9,9%	0,5%	-9,1%	-8,1%	-16,5%	-8,0%	-23,7%	-29,7%	14,6%	-22,1%	-10,7%
Sugar beet	91,1%	-62,8%	-28,9%	1,3%	4,6%	7,2%	12,1%	12,6%	-17,1%	-6,6%	37,7%	-17,2%	14,0%	17,8%	-49,5%	-40,5%
Sunflower seeds	21,7%	-10,1%	9,4%	1,8%	-7,4%	40,5%	30,1%	-0,7%	55,0%	54,0%	-17,9%	-41,6%	-52,1%	61,1%	-29,3%	13,9%
Sorghum	-24,6%	-81,4%	-86,0%	0,1%	5,1%	-50,2%	-47,6%	10,0%	-54,3%	-49,7%	-11,0%	8,0%	-3,9%	-26,8%	-24,5%	-44,7%
Tangerines, mandarins, clem.**	-23,4%	186,4%	119,4%	0,9%	1,5%	26,6%	28,5%	2,3%	27,7%	30,7%	-15,2%	57,6%	33,7%	-13,0%	12,4%	-2,3%
Clover	62,6%	-99,5%	-99,2%	0,1%	67,7%	-85,7%	-76,1%	-10,9%	-36,4%	-43,3%	3,0%	-75,3%	-74,6%	5,6%	-78,9%	-77,8%
Wheat	59,5%	-33,2%	6,6%	9,5%	-7,2%	-21,7%	-27,3%	-6,5%	6,1%	-0,8%	8,0%	8,0%	16,7%	70,1%	-25,6%	26,6%
Grapes	30,0%	-31,7%	-11,3%	10,9%	-5,6%	-7,6%	-12,8%	14,9%	-14,5%	-1,8%	14,3%	-14,8%	-2,6%	4,8%	1,4%	6,3%
Vetch	-1,9%	-19,2%	-20,7%	0,6%	-19,6%	-9,6%	-27,3%	-40,7%	32,3%	-21,5%	6,7%	276,8%	302,2%	92,6%	-82,1%	-65,5%
Rest of crops***	83,5%	-30,9%	26,8%	4,8%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	83,5%	-30,9%	26,8%
TOTAL except Rest of crops	17,9%	-7,1%	9,5%	95,2%	-9,0%	9,2%	-0,6%	0,0%	-1,3%	-1,3%	14,0%	-8,5%	4,3%	13,6%	-5,8%	7,0%
TOTAL	30,9%	-8,8%	11,7%	100,0%	-8,4%	8,6%	-0,5%	0,1%	-1,2%	-1,1%	12,7%	-7,9%	3,8%	18,5%	-7,6%	9,5%

* Constant productivity is assumed for 1980-1984 (where no data on area harvested is given by FAOSTAT while having production), for the crops Anise, badian, fennel,..., Chestnuts, NCP Spices, Raspberries and NCP Nuts.

** Gramin. & Legum.: Gramineous and leguminous; clem.: clementines.

*** In the *Rest of the crops* we include those with individual productivity and surface effect smaller than |0.01%|.

Source: Own elaboration.

Table 9: SDA of the Water consumption change. Productivity (P) and Surface (S) effects.

Classification	Productivity (P)	Surface (S)	Production	Water Consum.	P Effect	S Effect
Olives	27.50%	**113.60%**	**172.30%**	17.80%	**0.19%**	**0.57%**
Barley	**52.00%**	-9.70%	**37.20%**	13.30%	**0.27%**	-0.07%
Grapes	30.00%	**-31.70%**	**-11.30%**	10.90%	0.13%	-0.19%
Wheat	**59.50%**	**-33.20%**	6.60%	9.50%	**0.22%**	-0.19%
Almonds in shell	**-23.80%**	9.30%	**-16.70%**	7.20%	-0.07%	0.02%
Gramin. & Legum.*	35.78%	44.03%	**95.57%**	6.95%	0.04%	**0.14%**
Chilies, pepper	**136.70%**	-19.00%	**91.80%**	4.60%	**0.16%**	-0.04%
Corn	**96.50%**	**-20.60%**	**56.10%**	3.20%	0.08%	-0.03%
Grasses	-26.10%	**66.10%**	**22.70%**	2.30%	-0.03%	0.05%
Sunflower seeds	21.70%	-10.10%	9.40%	1.80%	0.01%	-0.01%
Oats	**66.00%**	16.00%	**92.50%**	1.50%	0.05%	0.01%
Locust beans	-13.60%	-67.00%	-71.50%	1.30%	-0.01%	-0.05%
Paddy	12.50%	48.50%	67.00%	1.30%	0.01%	0.02%
Oranges	28.30%	24.90%	**60.20%**	1.30%	0.01%	0.01%
Potatoes	-25.60%	-41.90%	-56.80%	1.30%	-0.01%	-0.03%
Sugar beet	91.10%	-62.80%	-28.90%	1.30%	0.03%	-0.04%
Rye	78.80%	-48.50%	-7.90%	1.10%	0.03%	-0.04%
Tangerines, mandarins, clem.**	-23.40%	**186.40%**	**119.40%**	0.90%	-0.01%	0.04%
Forage Maize	12.60%	-13.20%	-2.30%	0.80%	0.00%	0.00%
Peach, nectarine	74.30%	81.10%	215.70%	0.80%	0.02%	0.02%
Apples	24.90%	-38.00%	-22.50%	0.60%	0.01%	-0.01%
Vetch	-1.90%	-19.20%	-20.70%	0.60%	0.00%	0.00%
Total selected Crops				90.35%	1.12%	0.18%
Total All Crops				100%	**1.12%**	**0.04%**

* Gramin. & Legum.: Gramineous and leguminous; clem.: clementines.
Source: Own elaboration.

5 Final comments

Perhaps we should start these comments reminding that all results above refer to the physical consumption of water, excluding them such important issues as the uses of water, the role of rainfed and irrigation, which is a core issue of agricultural modernization and modernization of irrigation, or the return of water from agricultural and industrial uses. These issues are behind the changes we discussed, but are not considered directly in our model.

Our results tell us that the increase in water consumption from 1980 to 2007 is 26,354 hm^3, a high figure but that acquires its true dimensions when compared to the current population of Spain, 46 million people in 2011. The increase in consumption is therefore 573 m^3 per person now, more than 21,000 liters per person in each of the 27 years studied. Given the reduction occurred in the period 1986-1991, this figure is bigger in all the other periods. No doubt the number is very important. And we have not considered the import of water (nor discounted exports on the other hand), which likely would raise those figures given the current position as net importer of water.

We have seen that the main factor in water consumption growth has been the demand that has grown by changes in consumption habits, but also and in a very important way by population growth. Fortunately, improvements in production technologies, not only in agriculture, have led to significant reductions in water consumption, especially in agricultural goods further transformed (e.g. feed in the Food industry, which increased in importance with respect to agricultural products sold to livestock, reflected within the agrarian sector account) or/and sold to the final consumers and rest (e.g. goods via Hotels and restaurants). Without these reductions through cropping intensity (in water consumed per euro of production, although we find increases in water consumption per ton of production, assuming the total production of 1980) and technological means, consumption could have been three times the current.

All this leads us to think that it is key some kind of global policy, which encourages countries to increasingly make a better use of water and avoid environmental dumping mechanisms between them, and have into consideration with other factors such as the profitability of the crops, the state of the resources. That may be deduced from the final analysis by crops, where we see that productivity in many of them have grown strongly, revealing that the crop technology, technological improvements of the activities that use agricultural products as well as better consumer habits are ways to achieve significant water savings and greater respect for the environmental conditions of the water environment.

Acknowledgements

The authors acknowledge the useful comments received from professor B. Los, and the participants at the 19th International Input-Output Conference (Alexandria, USA, June 2011), where a previous version of this paper was presented. All errors and shortcomings are the authors' sole responsibility. The authors also want to thank the financial support of the Spanish Ministry of Science and Innovation through the project ECO2010-14929 and the Regional Government of Aragon-CAIXA through the project GA-LC-029/2009 and Ignacio Cazcarro thanks the SMSI for a FPU grant (AP2007-03816).

References

[1] Chapagain, A.K. and Hoekstra, A.Y. (2004) Water footprints of nations. *Value of Water Research Report Series* 16, UNESCO-IHE, Delft, The Netherlands. 1, 5

[2] Dietzenbacher, E. and Hoekstra, R. (2001) The RAS Structural Decomposition Approach. In: Hewings, G.J.D., Sonis, M. and Boyce, D. (eds) *Trade, Networks and Hierarchies: Modelling Regional and Interregional Economies (Berlin, Springer)*, pp. 179-199. 2, 4

[3] Dietzenbacher, E. and Los, B. (1998) Structural decomposition techniques: sense and sensitivity. *Economic Systems Research* 10, p. 307. 3

[4] Duarte, R. and Sánchez Chóliz, J. (2011) Technological components of income growth: An application to the evolution of the Spanish economy 1980-2007. Working paper of Economic Analysis Department, U. of Zaragoza (Spain). In evalution in *Economic Systems Reserarch* 2, 9

[5] Hoekstra and Van der Berg, (2002) Structural Decomposition Analysis of Physical Flows in the Economy, *Environmental and Resource Economics*, European Association of Environmental and Resource Economists, vol. 23(3), pp. 357-378. 1, 3

[6] FAO (2011) *Production of Crops and Livestock Primary*. FAOSTAT. Food and Agriculture Organization of the United Nations, Rome, Italy. 5

[7] Lenzen, M., Wiedmann, T., Barney, F., Dey, C., Widmer-Cooper, A., Williams, M. and Ohlemller, R. (2001) Forecasting the Ecological Footprint of Nations: a blueprint for a dynamic approach. ISA Research Paper 07/01. 3

[8] de Mesnard, L. (2000) Failure of the normalization of the RAS method: absorption and fabrication effects are still incorrect, RePEc, Germany. 2

[9] Paelinck, J. and Waelbroeck, J. (1963) Etude empirique sur l'évolution de coefficients input-output. Essai d'application de la procédure RAS de Cambridge au tableau interindustriel belge, *Economie Appliquée* 6, pp. 82-111. 2

[10] Rose A. and Chen, C. Y. (1991) Sources of Change in the Structure of Energy in the US Economy, Resources and Energy Economics, 13, 1-12(EI, SSCI). 3

[11] Rose, A. and Casler, S. (1996) Input-Output Structural Decomposition Analysis: A Critical Appraisal. *Economic Systems Research*, 8(1). 1, 3

[12] Stone, R. and Brown, J.A.C. (1962) A long-term growth model for the British economy, in: R.C. GEARY (ed.), Europe's future in figures, North-Holland, Amsterdam. 2

[13] WSA (2011) Water Satellite Accounts for Spain. *Statistics on the Environment. Environmental Statistics on Water*. National Statistic Institute. 5

[14] Van der Linden, J. and Dietzenbacher, E. (2000) The determinants of structural change in the European Union: a new application of RAS, *Environment and Planning A*, 32, 12, pp. 2205-2229. 2

6 Annex

Table 10: Effects of the water consumption in the period 1980-1985 (hm^3).

	Intensity effect		Technological effect		Internal effect		Forward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	-4,696.2	100.0	-5,585.2	112.4	90.6	58.9	-5,677.9	110.9	-20,788.2	103.8	15,203.0	100.9	14,961.1	92.0	4,677.7	70.8
Mining and quarrying	0.0	0.0	-39.2	0.8	-7.8	-5.1	-30.9	0.6	-69.4	0.3	30.3	0.2	46.4	0.3	7.7	0.1
Electricity,gas and water	0.0	0.0	712.9	-14.3	70.2	45.7	647.0	-12.6	876.1	-4.4	-163.2	-1.1	1,166.8	7.2	1,884.0	28.5
Electrical, optical, office & computing	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.4	0.0	-0.1	0.0	0.3	0.0	0.5	0.0
Chemical products	0.0	0.0	30.4	-0.6	3.2	2.1	27.7	-0.5	45.4	-0.2	-15.0	-0.1	3.3	0.0	34.2	0.5
Machinery	0.0	0.0	0.1	0.0	-0.1	-0.1	0.2	0.0	0.2	0.0	-0.1	0.0	-0.2	0.0	-0.1	0.0
Motor vehicles	0.0	0.0	0.1	0.0	-0.1	-0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.8	0.0	0.8	0.0
Coke, refined petroleum & nuclear fuels	0.0	0.0	-58.9	1.2	12.3	8.0	-71.1	1.4	-90.5	0.5	31.6	0.2	54.2	0.3	-4.6	-0.1
Rubber and plastic	0.0	0.0	12.0	-0.2	0.0	0.0	12.0	-0.2	13.7	-0.1	-1.7	0.0	-0.6	0.0	11.4	0.2
Other non metallic minerals	0.0	0.0	-6.0	0.1	0.4	0.3	-4.4	0.1	-4.1	0.0	0.2	0.0	1.4	0.0	-2.5	0.0
Basic metals & fabricated metal products	0.0	0.0	-17.7	0.4	-1.3	-0.9	-17.0	0.3	6.2	0.0	-24.4	-0.2	-1.7	0.0	-20.1	-0.3
Food industry	0.0	0.0	2.5	-0.1	-1.5	-0.9	-0.4	0.0	-10.1	0.1	8.3	0.1	12.2	0.1	10.4	0.2
Textile and footwear	0.0	0.0	-9.5	0.2	-7.2	-4.7	-2.4	0.0	-11.4	0.1	1.9	0.0	3.8	0.0	-5.8	-0.1
Wood and wood products	0.0	0.0	-7.1	0.1	-1.1	-0.7	-6.5	0.1	-7.7	0.0	0.1	0.0	5.3	0.0	-2.3	0.0
Pulp and paper	0.0	0.0	-4.9	0.1	-5.1	-3.3	0.2	0.0	5.7	0.0	-10.7	-0.1	11.4	0.1	6.5	0.1
Manufacturing	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
Construction	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	0.0	0.0	0.0
Communications	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.3	0.0
Business activities	0.0	0.0	3.1	-0.1	0.1	0.1	3.0	-0.1	3.1	0.0	0.0	0.0	-2.1	0.0	1.0	0.0
Wholesale, retail trade & recovery	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	-0.1	0.0	0.1	0.0
Hotels and restaurants	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	1.5	0.0	2.0	0.0
Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.5	0.0
Financial intermediation	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Real estate activities	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Other services	0.0	0.0	1.3	0.0	1.0	0.7	0.3	0.0	1.5	0.0	-0.2	0.0	3.0	0.0	4.3	0.1
TOTAL	-4,696.2	100.0	-4,968.1	100.0	153.7	100.0	-5,118.7	100.0	-20,028.1	100.0	15,060.0	100.0	16,267.3	100.0	6,606.2	100.0
% of the effect		-71.1		-75.1		0.6		-19.4		-303.2		228.0		246.2		100.0

Source: Own elaboration.

Table 11: Effects of the embodied water consumption in the period 1980-1985 (hm^3).

	Intensity effect		Technological effect		Internal effect		Backward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	839.2	-17.9	63.4	-1.3	90.6	58.9	-27.2	0.5	1,025.6	-5.1	-842.1	-5.6	6,027.7	37.1	6,930.3	104.9
Mining and quarrying	-2.1	0.0	29.4	-0.6	-7.8	-5.1	37.2	-0.7	-6.9	0.0	23.5	0.2	-15.2	-0.1	12.1	0.2
Electricity,gas and water	-9.4	0.2	85.3	-1.7	70.2	45.7	15.1	-0.3	-3.9	0.0	21.0	0.1	799.7	4.9	875.6	13.3
Electrical, optical, office & computing	-0.9	0.0	-10.1	0.2	0.0	0.0	-10.1	0.2	4.1	0.0	-14.7	-0.1	86.9	0.5	76.0	1.2
Chemical products	34.6	-0.7	47.4	-1.0	3.2	2.1	44.2	-0.9	99.9	-0.5	8.4	0.1	-159.7	-1.0	-77.6	-1.2
Machinery	-2.9	0.1	-31.6	0.6	-0.1	-0.1	-31.5	0.6	5.0	0.0	-43.4	-0.3	-72.2	-0.4	-106.7	-1.6
Motor vehicles	-44.8	1.0	-29.7	0.6	-0.1	-0.1	-29.5	0.6	-27.0	0.1	-47.6	-0.3	222.6	1.4	148.2	2.2
Coke, refined petroleum & nuclear fuels	4.2	-0.1	-131.3	2.6	12.3	8.0	-143.6	2.8	962.2	-4.8	-1,106.0	-7.3	430.4	2.6	303.3	4.6
Rubber and plastic	9.2	-0.2	43.9	-0.9	0.0	0.0	43.9	-0.9	13.9	-0.1	12.3	0.1	-127.5	-0.8	-74.4	-1.1
Other non metallic minerals	9.0	-0.2	-12.6	0.3	0.4	0.3	-13.0	0.3	41.2	-0.2	7.7	0.1	25.3	0.2	21.6	0.3
Basic metals & fabricated metal products	3.8	-0.1	-16.8	0.3	-1.3	-0.9	-15.4	0.3	1.5	0.0	-14.7	-0.1	-120.3	-0.7	-133.3	-2.0
Food industry	-3,313.3	70.6	-1,967.9	39.6	-1.5	-0.9	-1,966.4	38.4	-10,849.9	54.2	7,914.1	52.6	6,830.7	42.0	1,549.5	23.5
Textile and footwear	-270.5	5.8	-926.8	18.7	-7.2	-4.7	-919.6	18.0	-1,813.8	9.1	874.5	5.8	139.9	0.9	-1,057.3	-16.0
Wood and wood products	-57.9	1.2	-137.8	2.8	-1.1	-0.7	-136.7	2.7	-216.7	1.1	18.5	0.1	365.8	2.2	170.1	2.6
Pulp and paper	-40.4	0.9	-105.0	2.1	-5.1	-3.3	-99.9	2.0	-124.5	0.6	-72.4	-0.5	201.7	1.2	56.3	0.9
Manufacturing	-0.7	0.0	-80.1	1.6	0.0	0.0	-80.1	1.6	-26.0	0.1	-20.6	-0.1	-232.7	-1.4	-313.5	-4.7
Construction	-119.2	2.5	-684.7	13.8	0.0	0.0	-684.7	13.4	-612.9	3.1	77.6	0.5	-65.8	-0.4	-869.7	-13.2
Communications	-2.1	0.0	-1.0	0.0	0.0	0.0	-1.0	0.0	-1.3	0.0	-5.7	0.0	34.5	0.2	31.5	0.5
Business activities	2.7	-0.1	24.3	-0.5	0.1	0.1	24.2	-0.5	-18.2	0.1	11.1	0.1	-298.8	-1.8	-271.8	-4.1
Wholesale, retail trade & recovery	-66.6	1.4	129.1	-2.6	0.0	0.0	129.1	-2.5	-24.7	0.1	-52.1	-0.3	-69.2	-0.4	-6.7	-0.1
Hotels and restaurants	-1,184.7	25.2	198.5	-4.0	0.0	0.0	198.4	-3.9	-5,898.4	29.5	6,741.1	44.8	1,356.8	8.3	370.6	5.6
Transport	-26.0	0.6	-61.2	1.2	0.0	0.0	-61.2	1.2	-311.6	1.6	339.8	2.3	107.5	0.7	20.2	0.3
Financial intermediation	0.4	0.0	2.8	-0.1	0.0	0.0	2.8	-0.1	-0.7	0.0	0.6	0.0	-11.5	-0.1	-8.3	-0.1
Real estate activities	-18.8	0.4	95.9	-1.9	0.0	0.0	95.9	-1.9	-267.7	1.3	363.9	2.4	61.6	0.4	138.7	2.1
Other services	-438.9	9.3	-1,488.5	30.0	1.0	0.7	-1,489.6	29.1	-1,977.3	9.9	865.0	5.7	749.0	4.6	-1,178.4	-17.8
TOTAL	-4,696.2	100.0	-4,964.9	100.0	153.7	100.0	-5,118.7	100.0	-20,028.1	100.0	15,060.0	100.0	16,267.3	100.0	6,606.2	100.0
% of the effect		-71.1		-75.2		0.6		-19.4		-303.2		228.0		246.2		100.0

Source: Own elaboration.

Table 12: Effects of the water consumption in the period 1986-1991 (hm^3).

	Intensity effect		Technological effect		Internal effect		Forward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	-15,144.7	100.0	-7,520.2	105.6	83.8	126.3	-7,604.0	105.8	-21,027.0	100.3	13,500.1	97.5	20,149.8	93.1	-2,515.0	398.4
Mining and quarrying	0.0	0.0	-31.9	0.4	-0.1	-0.1	-31.8	0.4	-42.2	0.2	10.2	0.1	53.1	0.2	21.2	-3.4
Electricity,gas and water	0.0	0.0	476.2	-6.7	-17.7	-26.7	493.9	-6.9	196.5	-0.9	280.3	2.0	1,190.6	5.5	1,666.8	-264.0
Electrical, optical, office & computing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.6	0.0	0.6	-0.1
Chemical products	0.0	0.0	-30.7	0.4	1.0	1.5	-31.7	0.4	-47.6	0.2	17.2	0.1	96.3	0.4	65.6	-10.4
Machinery	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.2	0.0	0.5	0.0	0.5	-0.1
Motor vehicles	0.0	0.0	0.3	0.0	0.1	0.2	0.1	0.0	0.2	0.0	0.1	0.0	1.0	0.0	1.3	-0.2
Coke, refined petroleum & nuclear fuels	0.0	0.0	-1.7	0.0	0.0	0.0	-1.7	0.0	-9.0	0.0	7.5	0.1	0.7	0.0	-1.1	0.2
Rubber and plastic	0.0	0.0	14.5	-0.2	-0.1	-0.2	14.6	-0.2	10.2	0.0	4.5	0.0	5.8	0.0	20.3	-3.2
Other non metallic minerals	0.0	0.0	-1.6	0.0	-0.5	-0.7	-1.1	0.0	-2.6	0.0	1.1	0.0	14.2	0.1	12.7	-2.0
Basic metals & fabricated metal products	0.0	0.0	-45.2	0.6	-0.3	-0.4	-44.9	0.6	-61.4	0.3	16.9	0.1	25.9	0.1	-19.3	3.1
Food industry	0.0	0.0	0.1	0.0	-0.2	-0.3	0.3	0.0	-7.2	0.0	7.3	0.1	32.9	0.2	33.0	-5.2
Textile and footwear	0.0	0.0	3.7	-0.1	1.1	1.7	2.5	0.0	3.1	0.0	0.6	0.0	-2.9	0.0	0.7	-0.1
Wood and wood products	0.0	0.0	1.3	0.0	0.3	0.4	1.1	0.0	0.1	0.0	1.3	0.0	5.7	0.0	7.0	-1.1
Pulp and paper	0.0	0.0	8.2	-0.1	-1.5	-2.3	9.8	-0.1	12.7	-0.1	-4.4	0.0	35.8	0.2	44.0	-7.0
Manufacturing	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
Construction	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
Communications	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.8	-0.1
Business activities	0.0	0.0	5.2	-0.1	0.0	0.1	5.2	-0.1	5.4	0.0	-0.2	0.0	4.3	0.0	9.5	-1.5
Wholesale, retail trade & recovery	0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.1	0.0	1.9	0.0	2.2	-0.4
Hotels and restaurants	0.0	0.0	0.5	0.0	0.0	0.1	0.4	0.0	0.4	0.0	0.1	0.0	6.2	0.0	6.7	-1.1
Transport	0.0	0.0	0.4	0.0	0.0	0.1	0.4	0.0	0.4	0.0	0.1	0.0	0.6	0.0	1.0	-0.2
Financial intermediation	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
Real estate activities	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0
Other services	0.0	0.0	0.1	0.0	0.2	0.4	-0.1	0.0	0.2	0.0	-0.1	0.0	9.7	0.0	9.9	-1.6
TOTAL	-15,144.7	100.0	-7,119.8	100.0	66.4	100.0	-7,186.2	100.0	-20,967.3	100.0	13,842.7	100.0	21,633.1	100.0	-631.3	100.0
% of the effect		2,398.9		1,127.8		0.3		-27.3		3,321.3		-2,192.7		-3,426.7		100.0

Source: Own elaboration.

Table 13: Effects of the embodied water consumption in the period 1986-1991 (hm^3).

	Intensity effect		Technological effect		Internal effect		Backward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	831.9	-5.5	79.1	-1.1	83.8	126.3	-4.7	0.1	218.1	-1.0	-143.9	-1.0	134.2	0.6	1,045.2	-165.6
Mining and quarrying	-6.3	0.0	-6.9	0.1	-0.1	-0.1	-6.8	0.1	-4.5	0.0	6.7	0.0	95.0	0.4	81.9	-13.0
Electricity,gas and water	-8.6	0.1	-22.3	0.3	-17.7	-26.7	-4.5	0.1	-12.1	0.1	12.5	0.1	-564.9	-2.6	-595.7	94.4
Electrical, optical, office & computing	-10.3	0.1	-0.4	0.0	0.0	0.0	-0.4	0.0	-21.4	0.1	22.4	0.2	37.8	0.2	27.2	-4.3
Chemical products	37.7	-0.2	41.5	-0.6	1.0	1.5	40.5	-0.6	30.2	-0.1	-8.5	-0.1	268.5	1.2	347.6	-55.1
Machinery	-14.9	0.1	8.1	-0.1	0.0	0.0	8.1	-0.1	-41.0	0.2	41.4	0.3	9.7	0.0	2.9	-0.5
Motor vehicles	-124.7	0.8	-2.9	0.0	0.1	0.2	-3.1	0.0	-251.7	1.2	262.1	1.9	169.3	0.8	41.7	-6.6
Coke, refined petroleum & nuclear fuels	36.8	-0.2	-74.0	1.0	0.0	0.0	-74.0	1.0	100.4	-0.5	-179.0	-1.3	-157.4	-0.7	-194.6	30.8
Rubber and plastic	31.2	-0.2	14.7	-0.2	-0.1	-0.2	14.8	-0.2	55.7	-0.3	-27.1	-0.2	-215.4	-1.0	-169.5	26.8
Other non metallic minerals	31.7	-0.2	12.4	-0.2	-0.5	-0.7	12.9	-0.2	37.5	-0.2	-73.3	-0.5	-120.1	-0.6	-76.1	12.1
Basic metals & fabricated metal products	1.7	0.0	3.2	0.0	-0.3	-0.4	3.5	0.0	-4.9	0.0	8.3	0.1	-168.6	-0.8	-163.7	25.9
Food industry	-9,837.6	65.0	-4,667.4	65.6	-0.2	-0.3	-4,667.2	64.9	-12,671.3	60.4	8,328.2	60.2	14,328.7	66.2	-176.3	27.9
Textile and footwear	-725.6	4.8	-666.1	9.4	1.1	1.7	-667.2	9.3	-842.0	4.0	295.0	2.1	-208.2	-1.0	-1,599.8	253.4
Wood and wood products	-200.6	1.3	-33.6	0.5	0.3	0.4	-33.9	0.5	-254.6	1.2	193.1	1.4	-13.9	-0.1	-248.2	39.3
Pulp and paper	-98.9	0.7	-111.2	1.6	-1.5	-2.3	-109.6	1.5	-104.3	0.5	16.0	0.1	38.7	0.2	-171.4	27.1
Manufacturing	-18.2	0.1	-11.0	0.2	0.0	0.0	-11.0	0.2	-22.0	0.1	11.7	0.1	-15.3	-0.1	-44.5	7.0
Construction	-440.1	2.9	-54.6	0.8	0.0	0.0	-54.6	0.8	-723.6	3.5	697.2	5.0	1,510.1	7.0	1,015.5	-160.9
Communications	-5.4	0.0	-4.3	0.1	0.0	0.0	-4.3	0.1	1.1	0.0	-8.7	-0.1	1.0	0.0	-8.7	1.4
Business activities	-8.2	0.1	-24.3	0.3	0.0	0.1	-24.3	0.3	-10.0	0.0	-1.2	0.0	114.8	0.5	82.3	-13.0
Wholesale, retail trade & recovery	-191.9	1.3	-21.2	0.3	0.0	0.0	-21.2	0.3	2.2	0.0	-199.8	-1.4	599.8	2.8	386.7	-61.2
Hotels and restaurants	-3,186.6	21.0	-732.2	10.3	0.0	0.1	-732.3	10.2	-5,065.4	24.2	4,152.1	30.0	4,245.6	19.6	326.8	-51.8
Transport	-61.9	0.4	14.4	-0.2	0.0	0.1	14.3	-0.2	-54.0	0.3	65.6	0.5	10.8	0.0	-36.8	5.8
Financial intermediation	1.1	0.0	-1.7	0.0	0.0	0.0	-1.7	0.0	0.0	0.0	-2.2	0.0	-6.1	0.0	-6.6	1.1
Real estate activities	-44.8	0.3	-78.5	1.1	0.0	0.0	-78.5	1.1	59.6	-0.3	-122.9	-0.9	57.7	0.3	-65.6	10.4
Other services	-1,132.3	7.5	-780.9	11.0	0.2	0.4	-781.2	10.9	-1,389.3	6.6	496.9	3.6	1,481.5	6.8	-431.6	68.4
TOTAL	-15,144.7	100.0	-7,119.8	100.0	66.4	100.0	-7,186.2	100.0	-20,967.3	100.0	13,842.7	100.0	21,633.1	100.0	-631.3	100.0
% of the effect		2,398.9		1,127.8		0.3		-27.3		3,321.3		-2,192.7		-3,426.7		100.0

Source: Own elaboration.

Table 14: Effects of the water consumption in the period 1992-1998 (hm^3).

	Intensity effect		Technological effect		Internal effect		Forward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	-2,267.1	86.9	-9,477.1	78.0	-594.7	84.8	-8,882.3	77.5	-13,319.5	91.7	3,983.8	159.0	16,345.2	78.6	4,601.1	76.4
Mining and quarrying	23.9	-0.9	228.3	-1.9	-8.6	1.2	237.0	-2.1	375.9	-2.6	-156.1	-6.2	-249.2	-1.2	3.1	0.1
Electricity,gas and water	-381.2	14.6	-2,946.1	24.2	-130.3	18.6	-2,815.8	24.6	-1,663.3	11.4	-1,285.1	-51.3	4,446.6	21.4	1,119.3	18.6
Electrical, optical, office & computing	-0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	-0.1	0.0	0.9	0.0	0.9	0.0
Chemical products	3.3	-0.1	-8.5	0.1	-0.4	0.1	-8.1	0.1	14.0	-0.1	-21.2	-0.8	97.3	0.5	92.1	1.5
Machinery	-0.2	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.9	0.0	-0.2	0.0	0.6	0.0	1.1	0.0
Motor vehicles	-0.6	0.0	2.1	0.0	1.3	-0.2	0.7	0.0	2.8	0.0	-0.7	0.0	2.2	0.0	3.6	0.1
Coke, refined petroleum & nuclear fuels	-0.4	0.0	-44.3	0.4	5.8	-0.8	-50.1	0.4	-50.8	0.3	6.8	0.3	49.3	0.2	4.6	0.1
Rubber and plastic	-2.2	0.1	2.2	0.0	-1.6	0.2	3.8	0.0	11.2	-0.1	-8.4	-0.3	26.0	0.1	26.0	0.4
Other non metallic minerals	-4.9	0.2	-7.1	0.1	0.9	-0.1	-7.9	0.1	-6.7	0.0	-0.8	0.0	20.3	0.1	8.3	0.1
Basic metals & fabricated metal products	-10.9	0.4	16.2	-0.1	0.1	0.0	16.2	-0.1	21.1	-0.1	-5.1	-0.2	30.5	0.1	35.8	0.6
Food industry	7.0	-0.3	10.8	-0.1	6.0	-0.9	4.8	0.0	14.1	-0.1	-3.3	-0.1	-13.5	-0.1	4.3	0.1
Textile and footwear	13.9	-0.5	18.0	-0.1	11.6	-1.7	6.4	-0.1	25.9	-0.2	-8.1	-0.3	-13.1	-0.1	18.8	0.3
Wood and wood products	0.5	0.0	22.0	-0.2	0.3	0.0	21.6	-0.2	23.2	-0.2	-2.0	-0.1	-16.8	-0.1	5.6	0.1
Pulp and paper	10.2	-0.4	21.7	-0.2	7.9	-1.1	13.8	-0.1	15.3	-0.1	7.3	0.3	36.7	0.2	68.6	1.1
Manufacturing	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Construction	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
Communications	-0.5	0.0	0.5	0.0	0.2	0.0	0.3	0.0	0.4	0.0	0.1	0.0	1.3	0.0	1.2	0.0
Business activities	-2.8	0.1	3.0	0.0	0.1	0.0	2.9	0.0	3.1	0.0	-0.1	0.0	5.8	0.0	6.1	0.1
Wholesale, retail trade & recovery	0.2	0.0	1.0	0.0	0.2	0.0	0.8	0.0	1.2	0.0	-0.1	0.0	0.9	0.0	2.1	0.0
Hotels and restaurants	0.6	0.0	-1.2	0.0	0.0	0.0	-1.1	0.0	-1.1	0.0	-0.1	0.0	6.3	0.0	5.7	0.1
Transport	-0.1	0.0	1.0	0.0	0.1	0.0	0.9	0.0	1.0	0.0	0.0	0.0	0.6	0.0	1.4	0.0
Financial intermediation	0.0	0.0	-0.2	0.0	0.0	0.0	-0.2	0.0	-0.3	0.0	0.1	0.0	0.2	0.0	0.0	0.0
Real estate activities	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.4	0.0
Other services	2.9	-0.1	0.5	0.0	0.1	0.0	0.4	0.0	0.8	0.0	-0.3	0.0	5.5	0.0	9.0	0.1
TOTAL	-2,608.4	100.0	-12,156.3	100.0	-701.1	100.0	-11,455.2	100.0	-14,530.6	100.0	2,506.3	100.0	20,784.0	100.0	6,019.2	100.0
% of the effect		-43.3		-202.0		-2.7		-43.5		-241.4		41.6		345.3		100.0

Source: Own elaboration.

Table 15: Effects of the embodied water consumption in the period 1992-1998 (hm^3).

	Intensity effect		Technological effect		Internal effect		Backward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	2,523.7	-96.8	-616.3	5.1	-594,7	84,8	-21,5	0,2	-707.1	4.9	242.6	9.7	20,855.0	100.3	22,762.4	378.2
Mining and quarrying	-85.3	3.3	14.2	-0.1	-8,6	1,2	22,8	-0,2	45.3	-0.3	76.7	3.1	-1,550.8	-7.5	-1,621.9	-26.9
Electricity,gas and water	-199.1	7.6	-126.5	1.0	-130,3	18,6	3,8	0,0	121.9	-0.8	-354.9	-14.2	3,412.5	16.4	3,086.9	51.3
Electrical, optical, office & computing	6.9	-0.3	-50.9	0.4	0,1	0,0	-51,0	0,4	-44.1	0.3	11.2	0.4	146.4	0.7	102.4	1.7
Chemical products	20.1	-0.8	-9.4	0.1	-0,4	0,1	-9,1	0,1	-12.0	0.1	5.6	0.2	211.5	1.0	222.2	3.7
Machinery	-1.6	0.1	-15.7	0.1	0,0	0,0	-15,6	0,1	-29.1	0.2	1.2	0.0	38.4	0.2	21.1	0.4
Motor vehicles	-27.4	1.1	-260.5	2.1	1,3	-0,2	-261,8	2,3	-8.3	0.1	-211.7	-8.4	294.0	1.4	6.1	0.1
Coke, refined petroleum & nuclear fuels	53.9	-2.1	-100.6	0.8	5,8	-0,8	-106,4	0,9	116.0	-0.8	-175.7	-7.0	1,181.1	5.7	1,134.4	18.8
Rubber and plastic	20.0	-0.8	47.1	-0.4	-1,6	0,2	48,7	-0,4	17.5	-0.1	0.5	0.0	119.2	0.6	186.2	3.1
Other non metallic minerals	20.2	-0.8	13.4	-0.1	0,9	-0,1	12,5	-0,1	-2.4	0.0	17.8	0.7	418.0	2.0	451.7	7.5
Basic metals & fabricated metal products	13.8	-0.5	8.0	-0.1	0,1	0,0	7,9	-0,1	15.3	-0.1	-6.7	-0.3	35.2	0.2	57.0	0.9
Food industry	-4,418.0	169.4	-6,031.6	49.6	6,0	-0,9	-6.037,7	52,7	-8,549.2	58.8	4,246.1	169.4	-8,405.5	-40.4	-18,855.2	-313.3
Textile and footwear	-215.4	8.3	-447.0	3.7	11,6	-1,7	-458,6	4,0	2.6	0.0	-410.5	-16.4	-468.1	-2.3	-1,130.6	-18.8
Wood and wood products	-129.1	4.9	-34.6	0.3	0,3	0,0	-34,9	0,3	49.7	-0.3	10.0	0.4	-978.2	-4.7	-1,141.9	-19.0
Pulp and paper	-33.0	1.3	-93.2	0.8	7,9	-1,1	-101,1	0,9	-123.8	0.9	53.8	2.1	69.3	0.3	-56.9	-0.9
Manufacturing	89.6	-3.4	89.7	-0.7	0,0	0,0	89,7	-0,8	-81.7	0.6	-108.2	-4.3	677.9	3.3	857.2	14.2
Construction	-35.7	1.4	-74.6	0.6	0,0	0,0	-74,6	0,7	-843.6	5.8	177.7	7.1	46.8	0.2	-63.6	-1.1
Communications	-2.7	0.1	7.4	-0.1	0,2	0,0	7,3	-0,1	-23.8	0.2	67.3	2.7	102.2	0.5	107.0	1.8
Business activities	-1.8	0.1	2.2	0.0	0,1	0,0	2,1	0,0	-37.8	0.3	12.4	0.5	142.0	0.7	142.3	2.4
Wholesale, retail trade & recovery	319.7	-12.3	-167.4	1.4	0,2	0,0	-167,5	1,5	-596.4	4.1	-577.5	-23.0	299.9	1.4	452.3	7.5
Hotels and restaurants	-325.1	12.5	-2,744.8	22.6	0,0	0,0	-2.744,8	24,0	-2,835.7	19.5	-191.8	-7.7	3,269.6	15.7	199.7	3.3
Transport	11.3	-0.4	17.8	-0.1	0,1	0,0	17,6	-0,2	-255.0	1.8	133.8	5.3	40.9	0.2	70.0	1.2
Financial intermediation	2.4	-0.1	-7.4	0.1	0,0	0,0	-7,4	0,1	-3.2	0.0	0.0	0.0	33.4	0.2	28.4	0.5
Real estate activities	29.9	-1.1	133.9	-1.1	0,0	0,0	133,9	-1,2	143.8	-1.0	-122.6	-4.9	92.3	0.4	256.2	4.3
Other services	-245.8	9.4	-1,709.6	14.1	0,1	0,0	-1.709,6	14,9	-889.3	6.1	-391.0	-15.6	701.1	3.4	-1,254.2	-20.8
TOTAL	-2,608.4	100.0	-12,156.3	100.0	-701,1	100,0	-11.455,2	100,0	-14,530.6	100.0	2,506.3	100.0	20,784.0	100.0	6,019.2	100.0
% of the effect		-43.3		-202.0		-2,7		-43,5		-241.4		41.6		345.3		100.0

Source: Own elaboration.

Table 16: Effects of the water consumption in the period 1999-2007 (hm^3).

	Intensity effect		Technological effect		Internal effect		Forward effect		Fabrication effect		Substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	16,355.8	145.6	-19,223.8	129.5	-1,062.5	195.6	-18,161.3	127.0	-41,260.1	105.7	21,998.8	90.9	15,913.3	88.6	13,045.3	90.8
Mining and quarrying	-128.1	-1.1	353.5	-2.4	-34.0	6.3	387.5	-2.7	221.7	-0.6	139.7	0.6	-339.2	-1.9	-113.8	-0.8
Electricity,gas and water	-4,164.9	-37.1	3,976.0	-26.8	561.4	-103.3	3,414.5	-23.9	2,200.7	-5.6	1,789.7	7.4	2,139.1	11.9	1,950.2	13.6
Electrical, optical, office & computing	-1.8	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.3	0.0	0.2	0.0	-1.3	0.0
Chemical products	-316.7	-2.8	4.8	0.0	1.4	-0.3	3.4	0.0	-103.2	0.3	108.8	0.4	82.5	0.5	-229.3	-1.6
Machinery	0.9	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	-0.4	0.0	0.3	0.0	1.6	0.0	2.4	0.0
Motor vehicles	-7.7	-0.1	0.3	0.0	0.4	-0.1	-0.1	0.0	-0.6	0.0	0.9	0.0	1.7	0.0	-5.7	0.0
Coke, refined petroleum & nuclear fuels	-32.2	-0.3	13.2	-0.1	1.6	-0.3	11.6	-0.1	10.6	0.0	2.6	0.0	2.2	0.0	-16.9	-0.1
Rubber and plastic	-111.5	-1.0	7.3	0.0	-0.1	0.0	7.4	-0.1	-10.9	0.0	18.2	0.1	19.9	0.1	-84.2	-0.6
Other non metallic minerals	-21.9	-0.2	-2.3	0.0	0.4	-0.1	-2.7	0.0	2.3	0.0	-4.6	0.0	16.7	0.1	-7.5	-0.1
Basic metals & fabricated metal products	-99.8	-0.9	44.8	-0.3	-0.9	0.2	45.7	-0.3	29.9	-0.1	14.8	0.1	16.6	0.1	-38.4	-0.3
Food industry	81.7	0.7	-11.8	0.1	2.6	-0.5	-14.5	0.1	-40.5	0.1	28.7	0.1	29.8	0.2	99.6	0.7
Textile and footwear	-49.9	-0.4	1.0	0.0	-4.4	0.8	5.3	0.0	-16.1	0.0	17.1	0.1	-25.4	-0.1	-74.3	-0.5
Wood and wood products	-39.9	-0.4	-2.1	0.0	-0.5	0.1	-1.6	0.0	-6.0	0.0	3.9	0.0	6.8	0.0	-35.1	-0.2
Pulp and paper	-150.4	-1.3	-11.3	0.1	-10.3	1.9	-1.0	0.0	-75.2	0.2	64.0	0.3	64.7	0.4	-96.9	-0.7
Manufacturing	-0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
Construction	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
Communications	-2.6	0.0	0.4	0.0	-0.1	0.0	0.4	0.0	-0.2	0.0	0.5	0.0	1.4	0.0	-0.8	0.0
Business activities	-17.7	-0.2	5.7	0.0	-0.1	0.0	5.7	0.0	0.6	0.0	5.0	0.0	5.6	0.0	-6.4	0.0
Wholesale, retail trade & recovery	-6.3	-0.1	0.8	0.0	0.1	0.0	0.7	0.0	0.1	0.0	0.7	0.0	2.7	0.0	-2.8	0.0
Hotels and restaurants	-13.3	-0.1	-0.5	0.0	0.0	0.0	-0.5	0.0	-1.0	0.0	0.5	0.0	6.3	0.0	-7.6	-0.1
Transport	-2.9	0.0	1.0	0.0	0.2	0.0	0.8	0.0	0.2	0.0	0.8	0.0	0.4	0.0	-1.5	0.0
Financial intermediation	-0.3	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.3	0.0	-0.1	0.0
Real estate activities	-0.9	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.1	0.0	-0.4	0.0
Other services	-39.2	-0.3	2.3	0.0	1.3	-0.2	1.0	0.0	0.7	0.0	1.6	0.0	22.6	0.1	-14.3	-0.1
TOTAL	11,230.3	100.0	-14,840.0	100.0	-543.3	100.0	-14,296.7	100.0	-39,046.9	100.0	24,192.4	100.0	17,969.9	100.0	14,360.2	100.0
% of the effect		78.2	0.0	-103.3		-2.1		-54.2		-271.9		168.5		125.1		100.0

Source: Own elaboration.

Table 17: Effects of the embodied water consumption in the period 1999-2007 (hm^3).

	Intensity effect		Technological effect		Internal effect		Backward effect		Fabrication effect		substitution effect		Demand effect		Δ W	
		%		%		%		%		%			%		%	
Agrarian S., hunting and forestry	6,405.3	57.0	-1,019.9	6.9	-1,062.5	195.6	42.6	-0.3	-2,044.5	5.2	821.7	3.4	5,017.1	27.9	10,402.5	72.4
Mining and quarrying	893.9	8.0	-29.4	0.2	-34.0	6.3	4.6	0.0	15.2	0.0	-112.7	-0.5	-1,469.5	-8.2	-605.0	-4.2
Electricity,gas and water	-1,737.9	-15.5	554.2	-3.7	561.4	-103.3	-7.3	0.1	160.5	-0.4	107.6	0.4	495.4	2.8	-688.3	-4.8
Electrical, optical, office & computing	-20.5	-0.2	28.9	-0.2	0.0	0.0	28.9	-0.2	-36.4	0.1	37.7	0.2	-79.0	-0.4	-70.6	-0.5
Chemical products	-29.5	-0.3	1.5	0.0	1.4	-0.3	0.1	0.0	-30.2	0.1	23.1	0.1	22.8	0.1	-5.2	0.0
Machinery	-28.7	-0.3	13.9	-0.1	0.0	0.0	13.9	-0.1	-39.1	0.1	33.4	0.1	134.7	0.7	119.8	0.8
Motor vehicles	-221.2	-2.0	72.9	-0.5	0.4	-0.1	72.5	-0.5	-306.3	0.8	335.1	1.4	186.7	1.0	38.4	0.3
Coke, refined petroleum & nuclear fuels	-225.5	-2.0	36.7	-0.2	1.6	-0.3	35.1	-0.2	21.6	-0.1	63.0	0.3	125.6	0.7	-63.2	-0.4
Rubber and plastic	0.4	0.0	1.6	0.0	-0.1	0.0	1.7	0.0	-0.1	0.0	-1.3	0.0	70.6	0.4	72.6	0.5
Other non metallic minerals	-54.7	-0.5	36.4	-0.2	0.4	-0.1	35.9	-0.3	-10.4	0.0	43.8	0.2	313.8	1.7	295.5	2.1
Basic metals & fabricated metal products	31.5	0.3	-12.9	0.1	-0.9	0.2	-12.1	0.1	-1.0	0.0	-10.6	0.0	-128.0	-0.7	-109.5	-0.8
Food industry	4,588.7	40.9	-7,454.0	50.2	2.6	-0.5	-7,456.6	52.2	-17,830.5	45.7	10,720.8	44.3	5,553.8	30.9	2,688.6	18.7
Textile and footwear	106.0	0.9	-380.6	2.6	-4.4	0.8	-376.2	2.6	-785.2	2.0	443.7	1.8	-558.2	-3.1	-832.7	-5.8
Wood and wood products	-52.5	-0.5	102.0	-0.7	-0.5	0.1	102.5	-0.7	180.2	-0.5	-107.2	-0.4	239.4	1.3	288.9	2.0
Pulp and paper	-13.0	-0.1	-19.1	0.1	-10.3	1.9	-8.8	0.1	-199.0	0.5	82.2	0.3	120.8	0.7	88.7	0.6
Manufacturing	32.8	0.3	-274.2	1.8	0.0	0.0	-274.2	1.9	-378.8	1.0	186.4	0.8	-165.1	-0.9	-406.5	-2.8
Construction	-236.1	-2.1	-1,657.6	11.2	0.0	0.0	-1,657.6	11.6	-576.8	1.5	-327.4	-1.4	505.3	2.8	-1,388.4	-9.7
Communications	-61.4	-0.5	144.9	-1.0	-0.1	0.0	145.0	-1.0	-66.6	0.2	121.1	0.5	199.4	1.1	283.0	2.0
Business activities	-14.2	-0.1	48.1	-0.3	-0.1	0.0	48.2	-0.3	-82.2	0.2	49.6	0.2	-23.2	-0.1	10.7	0.1
Wholesale, retail trade & recovery	69.7	0.6	199.1	-1.3	0.1	0.0	199.1	-1.4	-1,804.2	4.6	872.9	3.6	1,253.9	7.0	1,522.7	10.6
Hotels and restaurants	2,291.4	20.4	-6,948.5	46.8	0.0	0.0	-6,948.4	48.6	-11,848.7	30.3	6,841.6	28.3	2,505.3	13.9	-2,151.8	-15.0
Transport	-49.8	-0.4	-52.9	0.4	0.2	0.0	-53.1	0.4	-119.6	0.3	45.3	0.2	-82.7	-0.5	-185.4	-1.3
Financial intermediation	-29.8	-0.3	42.7	-0.3	0.0	0.0	42.8	-0.3	-74.9	0.2	21.3	0.1	219.9	1.2	232.8	1.6
Real estate activities	-39.8	-0.4	-54.9	0.4	0.0	0.0	-54.9	0.4	12.9	0.0	-45.9	-0.2	19.7	0.1	-75.0	-0.5
Other services	-374.9	-3.3	1,781.0	-12.0	1.3	-0.2	1,779.7	-12.4	-3,202.8	8.2	3,947.1	16.3	3,491.5	19.4	4,897.6	34.1
TOTAL	11,230.3	100.0	-14,840.0	100.0	-543.3	100.0	-14,296.7	100.0	-39,046.9	100.0	24,192.4	100.0	17,969.9	100.0	14,360.2	100.0
% of the effect		78.2		-103.3		-2.1		-54.2		-271.9		168.5		125.1		100.0

Source: Own elaboration.