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Document de treball nº -7- 2011

DEPARTAMENT D'ECONOMIA – CREIP
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Adreçar comentaris al Departament d'Economia / CREIP

Dipòsit Legal: T -778- 2011

ISSN 1988 - 0812

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Water Reallocation in the Input-Output Model

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Abstract

Water reallocation between economic agents has been –and continues to be- the subject of a considerable amount of research. This paper proposes a method for evaluating how water is reallocated within the economy in response to changes in final demand and changes in the technical water needs of activities and consumers. The empirical application, which is for the Catalan economy, shows important asymmetries in the effects that exogenous inflows and changes in water technical requirements cause on water reallocation. In the process of water distribution, exogenous inflows mostly benefit agriculture and damage private consumers. On the other hand, increases in technical water requirements have negative effects on agriculture and positive effects on the other production activities. The results of the study suggest that agriculture is an important activity not only in terms of water distribution but also in terms of water reallocation due to changes in final demand and technical water needs.

Keywords: Water reallocation, water distribution, exogenous shock, technical water needs.

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1. Introduction

In recent decades, water research has become an important field in economic analysis. For various reasons, water supply has high level of rigidity. In most countries historical rights guarantee water provision to agents or associate water allocation to land owners. And the total amount of water is usually fixed and requires considerable investment and large-scale projects if it is to be increased. On the other hand, recently water demand has tended to increase largely due to demographic and economic growth. The rigid supply combined with the increasing demand leads to a structural disequilibrium problem in water resources that tends to intensify over time.

In those regions characterised by water scarcity, intense economic activity and high population, the imbalance between water availability and water needs has become a serious problem for local authorities. In this context, the question has emerged of how water endowments should be allocated and which criteria will ensure not only social equity but also economic efficiency.

There is no single solution to water allocation and the issue usually raises considerable controversy, because it has an economic and social dimension that involves all the inhabitants of an economy. An important question regarding water allocation is that in most countries water has not historically been allocated by markets but by property rights. When analysing reallocation, water research takes into account such arguments as the (possible) conflict of interests between the economic agents of any reallocation system and the impediments of the traditional water distribution to undertaking new activities with a greater value added than the current ones.

The literature has used a variety of methodologies to analyse the effects of water reallocation systems from different points of view. Seung et al (1998) used computable general equilibrium (CGE) techniques to analyse the economic effects of water transfers in the Walker River Basin of Nevada and California. Goodman (2000) compared the economic impacts of an increase in water storage with temporary water transfers between rural and urban communities in the Arkansas River Basin. Seung et al (2000) used a dynamic CGE model to evaluate the impacts of water reallocation in Churchill County, Nevada. Hewings et al (2005) evaluated the impact of water reallocation from agriculture to other productive sectors in a model that fully captured the feedback effects between sectors. Velázquez et al (2005) used a computable general equilibrium model to study the effects that an increase in the price of the water delivered to agriculture would have on the efficiency of water consumption. They also analysed the possible reallocation of water to other productive sectors in the Spanish region of Andalusia. Lennox and Varghese (2007) used a CGE approach to analyse water uses in Canterbury. More recently, Lennox and Diukanova (2011) used the general equilibrium framework to determine the regional effects of water reallocation in Canterbury. Finally, Cardenete and Hewings (2011) analysed sectorial water reallocation in Andalusia using a regional CGE model.

The conventional linear input-output model shows the interrelations in the production system and makes a representation of the interdependency between economic sectors. Therefore, it is a useful tool for capturing the interaction between water uses within the production system. In fact, the input-output model has been widely used to analyse water consumption and water needs since the pioneering work by Lofting and McCaughey (1968), who introduced water inputs as a productive factor in a traditional input-output model in order to evaluate the water requirements of the Californian economy. Since then, the model has been used to describe water uses and their interrelations within the production system.[1]

The input-output approach, which has always focused on analysing the patterns that explain total water consumption, can also be used to show water reallocation between sectors. However, as far as I know, Howe et al (1990) is the only paper that uses the input-output method to study water reallocation between the production system and urban consumers in the Arkansas River Valley in Colorado.

The objective of this paper is to adapt the conventional Leontief model in such a way that it will be able to show water reallocation within the economy. Specifically, I calculate the changes in the water distribution caused by both exogenous shocks in final demand and efficiency improvements in the water requirements of agents. In order to completely capture the agents involved in water uses, I define an extended input-output approach that contains not only the sectorial relations but also the final consumption in the endogenous part of the model. The method used accounts for the relative water consumed by sectors and consumers and shows how the exogenous inflows in final demand and the changes in technical water requirements modify the relative importance of agents within the total consumption of water.[2] The analysis can be regarded as a water reallocation measurement that highlights the interdependence between the consumption and production of any water distribution process. I apply this analytical context to the Spanish region of Catalonia, using the most recent economic and environmental information available.

[1] Among others, we can quote Duarte et al (2002), Velázquez (2006) and Dietzenbacher and Velázquez (2007).

[2] In a similar fashion, the input-output model has been used to analyse income distribution (Roland-Holst and Sancho, 1992). Llop and Manresa (2004) studied the income distribution process in a social accounting matrix model. And Butnar and Llop (2007) presented an input-otuput model to analyse greenhouse emissions in relative terms.

Catalonia is a Mediterranean region with limited water resources that depend to a considerable extent on rainfall. As the population is concentrated on the coast and the water resources are mainly in the mountains, there are permanent imbalances between regional water resources and regional water requirements. In the last decade, water scarcity has become an important problem for the regional authorities, particularly during periods of lack of rainfall, and this problem opened the debate on how to allocate regional water and solve the regional water problem.

This paper helps to understand the factors that underlie water reallocation. How changes in exogenous demand and in technical water needs affect the distribution of water are interesting questions for water analysis and resources research. The approach presented here extends our knowledge of the economic-ecologic relationships that affect water allocation.

The results show important asymmetries in the individual effects that exogenous inflows and technical changes have on water reallocation. When there are generalised exogenous inflows to all economic agents, agriculture is the sector that most benefits in terms of water distribution, while consumers are the most damaged. Additionally, when agents have greater water needs, agriculture reduces its relative water consumption to a greater extent while other sectors are positively affected by the reallocation process.

The rest of the paper is organised as follows. Section 2 describes the extended input-output model of water consumption and presents the relative measurements of water distribution. Section 3 describes the databases used in the empirical application to the Catalan economy and section 4 contains the empirical results. A conclusions section ends the paper.

2. Modelling relative water consumption

The analytical framework that accounts for water distribution is based on an extended input-output approach that includes not only sectors of production but also consumers. The standard representation of the input-output model, in matrix notation, can be defined as follows:

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

In expression (1), x is the final output vector and has $n+1$ elements (n production activities and 1 household sector). Similarly, y is the final demand vector for the $n+1$ elements (n remaining final demand for sectors and 1 final demand for the output of households). Finally, matrix A has the following structure:

$$A = \begin{bmatrix} \overline{A} & u \\ 0 & 0 \end{bmatrix},$$

where u is a column vector of sectorial consumption coefficients, calculated by dividing the sectorial consumption by the total private consumption of the economy and $\overline{A}$ is a submatrix of the input-output technical coefficients for n activities, calculated by dividing the intermediate consumption by the output in each sector.

The multiplier analysis assumes that the technical coefficients are constant, so matrix A does not vary. In expression (1), $(I - A)^{-1}$ is the matrix of extended input-output multipliers and shows the overall effects (direct and indirect) on sectorial production and consumption caused by unitary and exogenous changes in the final demand.

The model described in (1) can be used to account for the water consumption of sectors of production and consumers. Let W be the diagonal matrix of water consumption per unit of output in sectors and consumers, respectively. In this matrix, each element in the main diagonal is the amount of water consumed (in physical units) per monetary unit of final production (the water technical coefficients), and the elements outside the main diagonal are null. The total water consumption associated with a given level of final demand can then be calculated as follows:

$$l = W(I - A)^{-1} y \,, \tag{2}$$

where l is the column vector of physical water used by sectors and consumers. Following expression (2), the changes in the amount of water uses (dl) caused by changes in the final demand (dy) can be calculated as:

$$dl = W(I - A)^{-1} dy \,. \tag{3}$$

Expression (3) captures the entire sequence between the exogenous shocks in demand (government expenditure, investment and exports) and the resulting impacts on total water consumed. Following the logic of the input-output model, new demand increases the sectorial production and consumption and, at the same time, it also increases water requirements.

The input-output model explains the process of water uses in greater depth. In particular, it makes it possible to analyse how changes in the final exogenous demand modify the distribution of water between activities and households. The vector of water distribution (or relative water consumption) can be defined by normalizing expression (2):

$$r = \frac{W(I - A)^{-1} y}{e'W(I - A)^{-1} y} = \frac{l}{e'l} \,, \tag{4}$$

where e' is a unitary row vector and r is a column vector that contains the relative water consumption or *water distribution*. Note that this vector is calculated by dividing the vector l of $n+1$ water consumption (n for activities and 1 for consumers) by the total water uses.

Following expression (4), we can quantify the changes in the water distribution (*dr*) caused by unitary changes in the exogenous demand of production and consumption (*dy*) as follows:

$$dr = \frac{e'W(I-A)^{-1}yW(I-A)^{-1} - W(I-A)^{-1}ye'W(I-A)^{-1}}{\left[e'W(I-A)^{-1}y\right]^2}dy =$$

$$= \frac{1}{e'W(I-A)^{-1}y}\left[W - \frac{W(I-A)^{-1}ye'W}{\left[e'W(I-A)^{-1}y\right]}\right](I-A)^{-1}dy =$$

$$= \frac{1}{e'l}\left[W - \frac{le'W}{e'l}\right](I-A)^{-1}dy = Rdy\,. \tag{5}$$

In expression (5), *R* is the matrix of the changes in the water distribution or the *water reallocation* matrix. A generic element in this matrix R_{kz} shows the effect that a unitary inflow in the exogenous demand of *z* has on the relative water consumption of *k*. The elements of this matrix can be either positive or negative (that is, they can show a rise or a decrease in the relative water consumption of the accounts). Notice that this way of representing water uses involves a set of bilateral connections between activities and households and tells us how water is reallocated under the exogenous inflows in the final demand.[3]

It should be pointed out that, irrespective of the dimension of matrix *R*, the sum of the columns in this matrix is zero: $e'R = 0$. This means that the context of water reallocation

[3] The calculation of matrix *R* implicitly assumes that the total amount of water does not change (that is, the water availability is fixed) and that water can be transferred between sectors and consumers without any restriction (that is, there are no water rights or other legal and institutional restrictions to water transfers).

defined in expression (5) can be interpreted as a process of winners and losers in net terms.[4]

Another interesting question is how changes in the water requirements of agents can affect water distribution. Changes in the needs of water per monetary unit of production (that is, in the technical water coefficients) and their effect on water allocation is of maximum interest in water analysis. Understanding this relationship will improve knowledge about the consequences of reallocation policies aimed at promoting sustainable water consumption. Following expression (4) above, we quantify the changes in the water distribution (*dr*) caused by the changes in the technical requirements of water (*dW*) as follows:

$$dr = dW \frac{e'W(I-A)^{-1}y(I-A)^{-1}y - W(I-A)^{-1}ye'(I-A)^{-1}y}{\left[e'W(I-A)^{-1}y\right]^2} =$$

$$= dW \frac{1}{e'W(I-A)^{-1}y}\left[(I-A)^{-1} - \frac{W(I-A)^{-1}ye'(I-A)^{-1}}{\left[e'W(I-A)^{-1}y\right]}\right]y =$$

$$= dW \frac{1}{e'l}\left[(I-A)^{-1} - \frac{le'(I-A)^{-1}}{e'l}\right]y = dWt\,. \qquad (6)$$

In expression (6), *t* is the column vector of the changes in the water distribution, or the *water reallocation* vector, caused by the changes in the water requirements. In order to show the bilateral effects between the accounts, we can calculate matrix *T* which contains the reallocation effects of the accounts on the others. This matrix responds to:

$$T = \frac{1}{e'l}\left[(I-A)^{-1} - \frac{le'(I-A)^{-1}}{e'l}\right]Y\,, \qquad (7)$$

[4] This mathematical property may not be realistic when water availability increases. In this situation, water reallocation may involve global gains.

where *Y* is the diagonal matrix containing the elements of *y* in the main diagonal and zeros elsewhere. A generic element of matrix *T*, T_{kz}, shows the effect that a unitary increase in the water coefficient of *z* has on the relative water consumption of *k*. As in the preceding matrix *R*, the elements in *T* can be either positive or negative (that is, they can show a rise or a decrease in the relative water consumption). This method of representing water uses also involves a set of bilateral connections between activities and households and reveals how water is reallocated in response to changes in the water needs per unit of output.

As before, irrespective of the dimension of matrix *T*, the sum of the columns is null: $e'T = 0$. This means that expression (6) can be interpreted as a process of winners and losers in net terms and that there are no overall positive (or negative) gains.

The analytical method described above shows how water distribution is modified by changes in sectorial demand and in the technical water requirements of agents. The study of changes in relative water consumption, or water reallocation, therefore, improves our understanding of the reasons for the effects on the water distribution process.

3. Database

To empirically implement the model, I use regional information about the economic relations between sectors and consumers and about water uses in the economy. More specifically, the source of statistics is a regional social accounting matrix for the Catalan economy (SAMCAT), which contains data for the 2001. It is used to calculate matrix *A*, vector *y* and vector *x* of the distribution model presented in section 2. This database shows a level of disaggregation of 15 activities (agriculture, eight differentiated industries, construction and five differentiated services) and a generic account that shows the income and expenditure relations of the private agents in the regional economy.[5]

The information on water uses is the most recent data on the amount of physical water consumed by activities and households. It is for the year 2004 and is measured in cubic hectometres (hm^3) consumed in a year.[6] The data on total water uses is organized in a vector *l* of dimension $n+1\times1$ whose elements contain the amount of water consumed by *n* domestic industries and 1 aggregated consumer. Additionally, I calculate matrix *W* by dividing the amount of physical water consumed (that is, the elements in vector *l*) by the sectorial output (that is, the elements in vector *x*). The resulting values, or water technical coefficients, are placed on the main diagonal of matrix *W*.

4. Empirical application to Catalan water consumption

The analytical context discussed in section 2 shows how exogenous and unitary inflows to final demand affect the water distribution between economic agents. It also shows how changes in technical water requirements modify water distribution.

[PLACE TABLE 1 HERE]

Table 1 shows the relative water consumption or water distribution (vector *r*), which was calculated by dividing the total water used by each account (*l*) by the total water uses of the economy (*e'l*). The elements in table 1 show that the water distribution in the Catalan economy is highly asymmetric: agriculture (account 1) consumes most of the

[5] Llop (2011) describes the process of construction and the structure of the social accounting matrix for Catalonia.
[6] This information has been calculated from two different sources. The data available in Termes and Guiu (2009) have been used to obtain the total water consumed in the region, and the data from the Agencia Catalana de l'Aigua (2008) have been used to obtain the water consumed within the production system.

total uses (71.62%) followed by consumers (account 16) with 18.13%. These two agents, then, jointly use practically 90% of the total water consumed in the region.[7]

[PLACE TABLE 2 HERE]

Table 2 shows the water reallocation when there are exogenous and unitary inflows in both the production sectors and consumers. Specifically, these exogenous inflows can come from a unitary increase in public expenditure, investment or exports. Table 2 modifies the original changes in water reallocation, as it contains the non-normalized elements corresponding to the matrix (*e'l*)*R*. The values in table 2 then show how many cubic hectolitres of water are reassigned among sectors and consumers when the total water consumption is held constant at the initial level. In other words, they show the amount of water that change from one account to another because of the changes in the water distribution (or the amount of water that is reallocated between agents). For example, the first element in table 2 shows that when agriculture (account 1) receives an exogenous inflow, its relative water consumption increases by 76.219 hm^3. On the other hand, the same inflow reduces the relative water of consumers (account 16) by 48.917 hm^3. Notice that the columns in this table add up to zero as do those in matrix *R*, and this means that we can interpret this table as a process of winners and losers in which the effects on sectors and consumers compensate for each other.

Reading down the columns in table 2 shows how much water is reallocated among activities and consumers under an exogenous and unitary increase in the demand of the account in the column. Agriculture (account 1) has the largest column values and this means that this is the activity that most modifies water distribution under exogenous changes in demand.

[7] This water distribution is very different from the European Union's, where agriculture uses an average

The information in the rows in table 2 shows the changes in the water distribution of the account in the row when there is an exogenous and unitary increase in the final demand of all the accounts. Again, agriculture (account 1) shows the largest value: its relative water consumption increases by 82.792 hm^3 when all the activities and consumers raise their demand by one monetary unit. On the contrary, the row sum for consumers (account 16) is the smallest, and their relative water is reduced by 67.569 hm^3.

It is interesting to analyse the symmetry between pairs of elements in table 2. Symmetry in bilateral links means that there is the same type of effect (positive or negative) in two accounts when they receive an exogenous inflow. Positive symmetry means that the relationships between two accounts are reciprocally beneficial in terms of the water distribution process. As table 2 shows, there are a lot of positive symmetries between accounts, but none of them involves agriculture (account 1) or consumers (account 16).

Another important aspect is that, except along the main diagonal, the negative bilateral effects dominate (59% approximately). The elements along the main diagonal show the water distribution generated to each account as a result of its own exogenous inflows and are positive in all accounts.

The row sum in table 2 points out that, while the relative water consumption of agriculture (account 1) increases under a new and exogenous demand to all economic agents, the relative water of the other agents reduces, with the following exceptions: paper production (account 8), finance (account 13) and public services (account 15). These three accounts show positive row sums (0.243, 0.112 and 1.083 hm^3 of water, respectively).

[PLACE TABLE 3 HERE]

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of 24% of the total water consumed, energy uses 44%, consumers use 17% and industry uses the remaining 15% (Ecologic Institute, 2007).

Table 3 shows another aspect of water reallocation: the changes in water distribution when there are unitary increases in water coefficients (i. e. in water uses per unit of output). Table 3 contains the non-normalized elements for the matrix (*e'l*)*T* and indicates how much water is reallocated when the total water uses are held constant at the initial level. For instance, the first element in table 3 shows that when agriculture (account 1) increases its water coefficient by one unit, its relative water consumption increases by 0.075 hm^3. Again, the columns in this table add up to zero, as this information can also be regarded as a process of winners and losers in net terms.

Reading down the columns in table 3 shows how much water is reallocated among the activities and consumers under a unitary increase in the water coefficient of the account in the column. In absolute terms, consumers (account 16) have the largest column values and this means that when private agents increase their technical water needs the water distribution is subject to the highest modifications.

The rows in table 3 reflect how many hm^3 of water are reallocated to the account in the row when there is a unitary increase in the water coefficient of all the accounts simultaneously. Agriculture (account 1) shows the largest adjustment but, unlike the previous table, its relative water consumption decreases (by 299.235 hm^3) when all the activities and consumers raise their technical water requirements. The row sum of consumers (account 16) also show a negative impact (-4.367 hm^3) while the other accounts have positive reallocation effects. Of these, it is interesting to point out the values of other services (account 14), with 52.555 hm^3, metals (account 4), with 46.232 hm^3, and commerce (account 11), with 43.735 hm^3.

The values in table 3 suggest that the generalised increases in water needs per unit of output, not only reduce the relative water of agriculture but also increase the relative water consumption of the other production sectors.

The analysis of water reallocation within the input-output model completes our knowledge of the water distribution process. This allows us to disentangle the underlying water interdependences within the economy and provides interesting information about the effects of water reallocation on economic agents.

5. Conclusions

This paper has presented a method for analysing the water reallocation consequences of changes in both the final demand of agents and technical water requirements. The empirical application is for the Catalan economy and I have used both economic and water information, for the years 2001 and 2004, respectively. Specifically, I have redefined the input-output model to account for the water distribution (or relative water consumption) and how this distribution is modified by changes in the exogenous demand and the technical water requirements. The method presented has revealed that modifications to the relative water consumption of agents can be regarded as a set of bilateral connections that tell us how the inflows to activities and consumers affect the water distribution process and how the water distribution is affected by unitary increases in the technical water needs.

Our application to Catalan water uses reveals important asymmetries in the individual effects of exogenous inflows and technical water changes on the water reallocation. More specifically, agriculture is the sector that most benefits from the generalised exogenous inflows to all economic agents, while consumers are the most damaged. Additionally, when agents increase their water needs agriculture reduces its relative water consumption to a greater extent while other production activities are positively affected by the reallocation process. This suggests that any water reallocation policy should take into account the automatic mechanisms that take place within the economic system. The context presented in this paper show that these automatic effects could be of great importance in terms of their ability to reallocate the water resources.

Water distribution is a challenging issue in both economic and ecologic research. This paper may help to clarify some of the underlying effects that affect the water distribution process. To completely understand the implications of water reallocation, further research should be carried out to take into account several aspects not captured by the input-output model, such as the ability to increase total water resources and the historical rights that impede water transfers among agents.

Acknowledgements

The author acknowledges the institutional support of the *Ministerio de Educación y Cultura* (grant ECO2010-17728) and the *Generalitat de Catalunya* (grant SGR2009-322 and "*Xarxa de Referència d'R+D+I en Economia i Polítiques Públiques*").

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Table 1. Water distribution (*r*)

Accounts		
1	Agriculture	71.62%
2	Energy	0.32%
3	Chemistry	2.31%
4	Metals	0.33%
5	Automobiles	0.13%
6	Food	1.05%
7	Textiles	0.79%
8	Paper	0.63%
9	Other industry	0.16%
10	Construction	0.40%
11	Commerce	0.26%
12	Transportation	0.31%
13	Finance	0.24%
14	Other services	2.47%
15	Public services	0.86%
16	Consumers	18.13%
Total		100.00%

Table 2. Water reallocation under exogenous and unitary shocks [(*e'l*)*R*]: hm^3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	76.219	-0.664	-2.230	-0.213	-0.201	16.822	0.235	-1.319	0.464	-0.356	1.549	-0.482	-0.694	-0.939	-3.207	-2.191	82.792
2	-0.852	0.851	0.029	0.008	0.008	-0.196	-0.017	0.007	0.031	0.022	0.007	0.066	0.009	0.012	0.012	-0.019	-0.024
3	-6.127	0.003	3.519	0.061	0.083	-1.442	0.061	0.120	0.227	0.071	-0.129	0.002	-0.017	0.025	-0.106	-0.436	-4.084
4	-0.899	0.006	-0.012	0.280	0.050	-0.215	-0.034	-0.010	0.006	0.043	-0.014	0.006	-0.002	0.003	-0.014	-0.064	-0.870
5	-0.340	-0.001	-0.007	-0.001	0.219	-0.083	-0.015	-0.006	-0.006	-0.002	-0.003	0.003	-0.001	-0.002	-0.007	-0.019	-0.272
6	-2.694	-0.011	-0.021	-0.005	-0.005	0.953	-0.071	-0.038	-0.032	-0.017	0.014	-0.008	-0.011	-0.016	-0.060	-0.058	-2.079
7	-2.134	-0.007	-0.041	-0.003	0.002	-0.519	2.538	-0.024	0.017	-0.005	-0.053	-0.004	-0.008	-0.012	-0.038	-0.096	-0.387
8	-1.678	-0.002	0.012	0.014	0.008	-0.372	-0.046	2.270	0.016	0.005	0.002	0.020	0.020	0.033	0.030	-0.089	0.243
9	-0.432	0.003	0.000	0.012	0.019	-0.096	-0.015	0.000	0.287	0.041	-0.005	0.003	-0.001	0.000	-0.007	-0.026	-0.217
10	-1.073	0.043	-0.012	0.003	0.002	-0.255	-0.042	-0.015	-0.006	0.672	-0.019	0.013	0.003	0.006	-0.013	-0.077	-0.769
11	-0.693	-0.001	-0.008	0.004	0.004	-0.161	-0.019	-0.006	-0.004	0.004	0.174	0.005	-0.001	-0.001	-0.011	0.010	-0.705
12	-0.819	0.007	-0.003	0.007	0.018	-0.187	-0.025	0.003	0.004	0.012	0.016	0.552	0.015	0.011	0.005	-0.015	-0.400
13	-0.630	0.003	-0.005	0.005	0.005	-0.145	-0.018	0.003	-0.001	0.009	0.003	0.012	0.852	0.023	-0.004	0.000	0.112
14	-6.621	0.017	-0.056	0.051	0.045	-1.505	-0.228	-0.010	-0.044	0.040	0.002	0.092	0.071	1.392	0.007	-0.110	-6.857
15	-2.309	-0.011	-0.053	-0.010	-0.012	-0.568	-0.104	-0.044	-0.043	-0.024	-0.070	-0.013	-0.011	-0.024	4.589	-0.208	1.086
16	-48.917	-0.235	-1.112	-0.212	-0.247	-12.031	-2.201	-0.930	-0.915	-0.514	-1.473	-0.265	-0.225	-0.511	-1.177	3.397	-67.569
Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

Table 3. Water reallocation under unitary increases in water requirements [(*e'l*)*T*]: hm^3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	0.075	-2.963	-15.879	-26.909	-17.524	-10.013	-7.796	-5.571	-9.638	-19.955	-11.096	-6.463	-1.487	-22.138	-5.998	-135.881	-299.235
2	0.021	3.449	0.936	0.309	0.189	0.205	0.174	0.135	0.528	0.587	0.422	0.525	0.023	0.550	0.271	6.079	14.404
3	0.007	-0.066	16.288	-0.128	-0.031	-0.098	0.472	0.190	0.622	0.020	-0.179	-0.146	-0.042	-0.084	-0.105	-1.341	15.379
4	0.014	0.110	0.417	30.816	3.234	0.269	0.134	0.120	0.764	3.244	0.488	0.212	0.011	1.057	0.173	5.168	46.232
5	0.004	-0.001	0.007	0.051	16.423	0.021	0.008	0.002	0.012	0.062	0.347	0.111	0.000	0.101	0.026	4.310	21.483
6	0.079	-0.038	0.176	-0.266	-0.170	10.862	0.129	-0.033	-0.027	-0.168	0.482	-0.070	-0.019	-0.128	-0.056	8.179	18.931
7	-0.008	-0.029	-0.124	-0.215	-0.104	-0.104	8.163	-0.025	0.120	-0.098	-0.072	-0.053	-0.015	-0.137	-0.025	2.050	9.324
8	-0.003	-0.017	0.243	0.058	-0.024	0.127	0.037	5.894	0.130	0.010	0.180	0.029	0.011	0.392	0.184	1.435	8.688
9	0.007	0.040	0.454	1.204	1.090	0.375	0.100	0.130	8.987	2.473	0.267	0.081	0.005	0.322	0.061	3.472	19.069
10	0.007	0.204	0.203	0.163	0.089	0.107	0.026	0.014	0.139	16.911	0.152	0.134	0.014	0.505	0.102	1.871	20.643
11	0.025	0.028	0.490	0.789	0.505	0.509	0.380	0.147	0.376	0.817	9.798	0.213	0.015	0.654	0.152	28.837	43.735
12	0.012	0.054	0.431	0.472	0.631	0.315	0.150	0.178	0.321	0.612	0.863	6.752	0.060	0.874	0.324	9.805	21.853
13	0.004	0.013	0.125	0.171	0.090	0.100	0.062	0.074	0.080	0.234	0.244	0.084	1.749	0.736	0.074	5.314	9.153
14	0.006	0.000	0.470	0.634	0.256	0.611	0.083	0.232	0.174	0.564	1.117	0.306	0.072	23.184	0.582	24.263	52.555
15	-0.011	-0.035	-0.191	-0.322	-0.210	-0.148	-0.096	-0.067	-0.117	-0.240	-0.136	-0.077	-0.018	-0.266	5.762	-1.676	2.153
16	-0.239	-0.751	-4.047	-6.825	-4.445	-3.139	-2.028	-1.420	-2.471	-5.074	-2.876	-1.639	-0.377	-5.625	-1.526	38.114	-4.367
Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	