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Feeding the World via Transfer Payments – A General Equilibrium Approach

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Abstract

In order to finance worldwide adequate nourishment a general income tax to OECD countries is introduced. The resulting funds are transferred to regions with an insufficient calorie supply to increase their food budgets. This transfer mechanism as well as information about the available daily calories per person are introduced in the general equilibrium model of the Global Trade Analysis Project (GTAP).

The resulting tax rate is 0.83 percent of the OECD countries' income, respectively a required transfer payment of 167 billion USD. With the money allocated the receiver countries increase their domestic production as well as augment their food imports. This in turn affects agriculture in the OECD countries by slightly promoting production.

Keywords: general equilibrium model, DES, food security

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1 Introduction

Several international declarations, among them the Universal Declaration of Human Rights, include the right to adequate food and nutrition for everyone (WHO, 2000, p. 5). Nevertheless, over 800 million people are chronically undernourished (FAO, 1996, p. 45). The results are disease, loss of human potential, and death from starvation. For example, 49 percent of the 10.7 million children under the age of five who die in the developing world each year are associated with malnutrition (WHO, 2000, p. 9).

In view of this situation several initiatives have been launched. At the Food Summit 2002 in Rome the governments in attendance renewed their commitment to cut the number of hungry people in the world in half until 2015 (FAO, 2002a). The annual costs of the implementation of this resolution are estimated at approximately 25 billion USD (FAO, 2002b, p. 10). Another program is the *2020 Vision* of the International Food Policy Research Institute (IFPRI); its goal is sufficient food for everyone (IFPRI, 1995, p. 5).

This paper illustrates an unconventional approach to providing adequate nourishment for everybody. The basic idea is for countries of the Organization of Economic Co-Operation and Development (OECD) to introduce a general tax to finance sufficient nourishment all over the world. Countries with a prevalence of food inadequacy receive transfer payments from said tax fund to increase their food budget.

Based on this presumption this analysis aims to answer two questions: First, how high is the general income tax for OECD countries required in order to finance sufficient nourishment all over the world? Second, how do regions where undernourishment is a common problem meet the rising food demand once additional funds have been received? There are two possibilities: either they produce the additional food within their region or they increase food imports.

The transfer payments may cause substantial changes in the food markets within as well as outside of these regions. To analyze these changes the general equilibrium model of the Global Trade Analysis Project is used (GTAP, Hertel, 1997). Bach and Matthews (1999 and 2001) also used the GTAP model to study different food aid strategies.

The remaining sections of the paper are organized as follows: section two includes the necessary modifications of the GTAP model. In the third section the data used for this paper and the assumptions that were made are presented. All results are included in section four, whereas the advantages and limitations of the approach are discussed in section five. The last section draws a number of conclusions.

2 Modifications of the GTAP model

For this analysis two changes to the standard GTAP model are required. For one, the mechanism of transfer payments has to be modeled. Also, it is necessary to introduce information about nutrition into the model. In addition, the definition of the model's closure is discussed. A precondition for the model adjustment is the definition of two additional subsets.

2.1 Definition of additional Subsets

In contrast to the GTAP standard model, the regions are divided into donors and receivers. Hence, the set REG, which includes all regions, is split up into the two subsets DONOR and RECEIVER. Similarly, the set of tradable commodities (TRAD_COMM) is divided into food commodities (FOOD) and non-food commodities (NONFOOD).

2.2 Introduction of AIDFUND

In the GTAP model the regional income ($INCOME_r$) is made up of factor payments, taxes, and tariffs of region r. The regional income is entirely transferred to the three agents *private household*, *government*, and *savings*. All of them get a set share.

For the donor countries this transfer is multiplied with the coefficient *C*. *C* has a maximum value of 1 and (*1-C*) denotes the new introduced tax rate. The amount shifted to the global institution *AIDFUND* is the product of (*1-C*) and the regional income (Figure 1). The coefficient *C* is uniform across all donor countries. Therefore, the total amount transferred to *AIDFUND* is:

$$AIDFUND = \left[1 - C\right] \sum^{DONOR} INCOME_r \tag{1}$$

For the model implementation the equation 1 has to be linearized, or, in other words, completely differentiated. Small letters denotes percentage changes[1]:

$$aidfund = \frac{\left[1 - C\right] \sum^{DONOR} INCOME_r * income_r - \left[C * c \sum^{DONOR} INCOME_r \right]}{AIDFUND} \tag{2}$$

AIDFUND is completely spent on the receiver countries. $SUPPORT_r$ is the transfer payment that region r receives from *AIDFUND*:

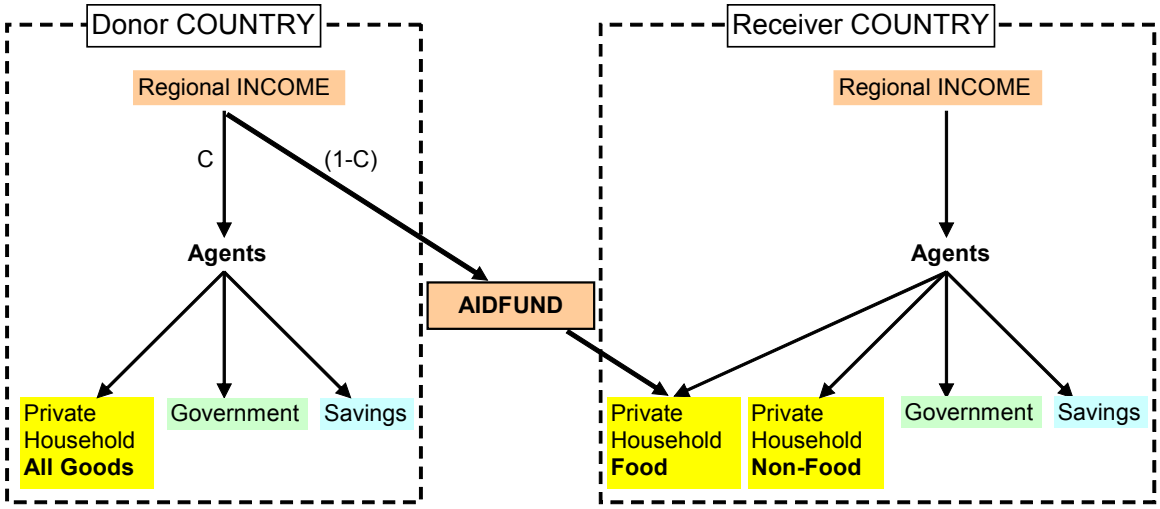
$$AIDFUND = \sum^{RECEIVER} SUPPORT_r \tag{3}$$

The linearized version of equation 3 is:

$$aidfund = \frac{\sum^{RECEIVER} SUPPORT_r * support_r}{AIDFUND} \tag{4}$$

[1] While coefficients are denoted by capital letters, small letters are used for variables, which mean percentage changes in linearized models.

Figure 1: Transfer Mechanism



It is important to ensure that the transfer payment is used exclusively for food by the receiver countries and not for other purposes. The budget as well as the demand structure of the private household has to be split into demands for food and non-food commodities. Therefore, a second private household is introduced in the receiver countries. Each of them buys either food or non-food commodities (Figure 1). Both households get a constant share of the regional income. Additionally, the food-buying household receives the transfer payment $SUPPORT_r$ from the *AIDFUND*. The budget for food in region r ($FOODBUDGET_r$) therefore consists of two parts; the constant share of food ($\delta_{FOOD,r}$) from the regional income and the transfer payment:

$$FOODBUDGET_r = \left[\delta_{FOOD,r} * INCOME_r\right] + SUPPORT_r \tag{5}$$

The linarized form of equation 5 is:

$$foodbudget_r = \frac{\left[\delta_{FOOD,r} * INCOME_r\right] income_r + SUPPORT_r * support_r}{FOODBUDGET_r} \tag{6}$$

We assume seperability between the food and the non-food household. For both of them the non-homothetic Constant Difference of Elasticities (CDE) function is applied. This enables a realistic depiction of food demand, even when the food budget rises, which is essential for this analysis.

The expansion parameters for the CDE function from the GTAP database (Dimaranan and McDougall, 2001) have to be adjusted in order to guarantee that the sum of the expansion parameters weighted with the cost shares are equal to one in both the food and the non-food household. Normally, this identity holds for the private household in the GTAP database (McDougall, 2002).

2.3 Information about Nutrition

Introducing information about nutrition into the model we concentrate on energy intake. The Food and Agriculture Organization of the United Nations (FAO) provides for all countries the per capita Dietary Energy Supply (DES) measurement. It indicates the daily available kilo calories per person within a country after subtracting food for seed, food wastage, stock changes, and food for animal consumption (Smith, 1998, p. 429). The FAO supplies also a detailed split of the per capita DES into several foodstuffs respectively sources of calories on so called food balance sheets[2].

In contrast, the GTAP database includes the amounts spent by the private household for a wide variety of raw food as well as processed food. The referring period is a year. Assuming that all prices are 1 in the database the amounts are equal to the quantities[3]. In order to connect the per capita DES information with the GTAP database two adjustments are required. First, we have to multiply all positions of food balance sheets with the population size and 365 days in order to get the available calories for a country during a year. Second, all aggregated calorie values have to be assigned to a food commodity sector of the GTAP database[4]. Contrary to the GTAP database, the FAO does not differentiate between raw and processed food in their food balance sheets. Therefore, an assumption in order to assign the calorie values to raw and processed products is

[2] It may be found at: http://apps.fao.org/page/collections?subset=nutrition
[3] This is a usual assumption in general equilibrium modeling.
[4] The food balance sheets of the year 1997 are used. Since the used GTAP 5 database is also referring to 1997, there is no inconsistency emerging from different base years.

necessary[5]. Following Bach and Matthews (1999, p. 30) the supposition is that the processing margin is 15 percent. Using this information the calories can be shared between raw and processed commodities. As a result of the assignation process we can build the coefficient $INGREDI_{i,r}$, which presents the calories of food commodity i per consumed quantity in region r[6]. We assume that $INGREDI_{i,r}$, is constant during the model simulation. Using the coefficient $INGREDI_{i,r}$ we can define the per capita DES of region r ($PERCAPITADES_r$):

$$PERCAPITADES_r = \frac{\sum^{FOOD} INGREDI_{i,r} * QP_{i,r}}{POPULATION_r * 365} \tag{7}$$

Multiplying $INGREDI_{i,r}$ with the consumed quantity of food i in region r ($QP_{i,r}$) and adding them for all elements of the set FOOD it results the total available calories in region r. Since $PERCAPITADES_r$ is on a personal and daily level we have to divide by 365 and $POPULATION_r$, the size of the population of region r. The linearized form of equation 7, meaning the percentage change of the $PERCAPITADES_r$ is:

$$percapitades_r = \frac{\sum^{FOOD} INGREDI_{i,r} * QP_{i,r} * qp_{i,r} - \left[\sum^{FOOD} INGREDI_{i,r} * QP_{i,r}\right] * population_r}{POPULATION_r * 365 * PERCAPITADES_r} \tag{8}$$

[5] For example one calorie position in the FAO food balance sheet is rice. The GTAP database includes two rice sectors, paddy rice and processed rice.

[6] In the GTAP database most of the developing countries are included a part of a region. Furthermore, in the used aggregation, which is described in section 3 the focus is on regions rather than single countries. Hence, the coefficient $INGREDI_{i,r}$ represents a weighted average of all countries, which are included in the region r.

[7] It may be found at: http://apps.fao.org/page/collections?subset=nutrition

[8] This is usual in general equilibrium analysis.

[9] Calculating $INGREDI_{i,r}$ it is important to keep in mind that the GTAP database refers to a year, while the per capita DES is on a daily basis.

2.4 Closure

The modified model requires five new variables: *c*, *aidfund*, $support_r$, $foodbudget_r$, and $percapitades_r$, whereby the last three variables are only used for receiver countries. In total, with n receiver countries there are 3n + 2 new variables. At the same time there are 2n + 2 new equations (equations 2, 4, 6, and 8). Consequently, a distinction in 2n + 2 endogenous and n exogenous variables is necessary. In the simulation within this paper all variables $percapitades_r$ are exogenous.

3 Assumptions

For this analysis, release 5 of the GTAP data base is used which refers to 1997 (Dimaranan and McDougall, 2001). Since this database is rather detailed (66 regions and 57 sectors) it is necessary to aggregate it for this simulation. In the case of the problem in question it makes sense to sum them up into 9 regions and 18 sectors[10].

The member countries of the OECD are donor countries. They are divided into three groups: the 15 member countries of the European Union (EU), the countries of the North American Free Trade Agreement (NAFTA) and the rest (rOECD, Table 1). The latter includes Australia, New Zealand, Japan, the Republic of Korea, Turkey, Hungary, Poland, as well as all countries of the European Free Trade Association (EFTA).

All Central and Eastern European countries and the successor countries of the former Soviet Union are designated transformation countries (TRANS). AFRICA and Latin and South America (LATIN) form two additional regions. Due to the large population of Asia it seems reasonable to separate its countries into two regions, according to their per capita DES level. The region ASIA1 comprises of countries with per capita DES levels lower than 2800 kilo calories (Bangladesh,

[10] The exact allocation of each country or region may be found in the appendix.

India, the Philippines, Sri Lanka, Thailand, and Vietnam). Asian countries with a per capita DES level higher than 2800 kilo calories belong to the region ASIA2 (China, Indonesia, Malaysia, Singapore, and Taiwan). All remaining countries, among them Afghanistan, Iran, Iraq, the Democratic People's Republic of Korea, Pakistan, and Saudi Arabia, are assigned to 'rest of the world' (ROW). Table 1 includes the population as well as the per capita DES value of each aggregated region[11]. With 2398 kilo calories per person and day AFRICA shows the lowest value.

Table 1: Population and Per Capita DES of 1997 for all Regions

Region	Population in Mill.	Per Capita DES
EU	375	3396
NAFTA	399	3507
rOECD	318	3080
TRANS	373	2876
AFRICA	739	2398
LATIN	401	2638
ASIA1	1314	2436
ASIA2	1478	2989
ROW	424	2528
World	5821	2794

Source: FAOSTAT from the internet[12] and own calculations based on FAOSTAT data

The aim of the aggregation of sectors is a detailed coverage of raw as well as processed food commodities. Commodities are paddy rice, wheat, other cereals, oil seeds, sugar beet and sugar cane, other plants (fruit, vegetables, roots, and pulses), livestock (living animals and eggs), raw milk, fish, meat, vegetable oils, dairy products, processed rice, processed sugar, beverages and tobacco products, other food, industry, and services. Since the FAO does not differentiate between raw and processed food in their food balance sheets, an additional assumption has to be made in order to be able to allocate calories to the various budget positions. Following Bach and Matthews (1999, p. 30) the supposition is that the processing margin is 15 percent.

The model simulation eliminates the prevalence of food shortage. We assume that this goal is achieved if the per capita DES value is at least 2800 kilo calories. In the Sixth World Food Survey

[11] The per capita DES levels are the weighted average of the per capita DES values of the countries in the referring region. The sizes of populations are used as weights.

[12] http://apps.fao.org/page/collections?subset=nutrition

the FAO calculated the minimal required per capita DES level for several country categories, taking into account the actual per capita DES level, the age-sex composition of the population, as well as the degree of inequality in food distribution within a country. The results were between 2730 and 2860 kilo calories per person and day (FAO, 1996, p. 61).

There are four regions, namely AFRICA, LATIN, ASIA1, and ROW, which show a per capita DES value below 2800 kilo calories (Table 1). In the simulation, their per capita DES level is raised, or to put it differently exogenously shocked. The regions TRANS and ASIA2 exceed the required per capita DES level (Table 1). Their per capita DES levels are kept constant in the simulation.

4 Results

The income tax introduced in the OECD countries is 0.83 percent. In absolute terms, this means transfer payments of 167 billion USD (Table 2). 77.1 billions go to the region ASIA1, while the regions AFRICA and LATIN get 35.8 and 23.6 billions respectively. Another 26 billions are transferred to ROW. The transfers to TRANS and ASIA2 are much smaller. Since their per capita DES levels are kept constant the transfer payments simply compensate for the increase of food prices.

The transfer payments have a worldwide impact on economic activities. The changes in the regional incomes provide important insights. The second round effects of the income tax in OECD countries lead to income decreases between 0.95 and 1.28 percent (Table 2). In addition, the 0.83 percent income tax need to be subtracted in order to get the budget changes of the private household, the government and the savings in the OECD countries.

Table 2: Transfer Payments, Changes in Regional Income and Food Budget

Region	Transfer Payments in Billion USD	Regional Income in %	Budget Change for Food in Receiver Countries in %
EU	*	-0.95	
NAFTA	*	-1.28	
rOECD	*	-0.96	
TRANS	0.7	-0.12	0.6
AFRICA	35.8	8.17	32.5
LATIN	23.6	3.35	11.7
ASIA1	77.1	15.69	58.7
ASIA2	3.9	0.22	1.5
ROW	26.2	4.06	21.4
Total	167.3		

*Donor Countries
Source: Own Calculations

In the regions AFRICA, LATIN, ASIA1, and ROW the transfer payments lead to a remarkable rise in their food budget (Table 2). The higher demand for food results in remarkable changes in the regional income. The quantity changes of private household demand may be found in Table 3.

Table 3: Quantity Changes of Private Household Demand in Percent

Sector	EU	NAFTA	rOECD	TRANS	AFRICA	LATIN	ASIA1	ASIA2	ROW
Paddy Rice	-0.7	-0.8	-0.3	-0.1	19.6	3.2	9.5	-0.1	6.9
Wheat	-0.3	-0.4	-0.3	0.0	6.6	3.2	9.5	0.0	7.0
Other Cereals	-0.4	-0.2	-0.3	0.0	11.4	3.2	9.1	0.0	6.7
Oil Seeds	-0.8	-0.4	-1.3	-0.2	22.2	5.7	24.1	-0.2	15.1
Sugar Beet/Cane	-0.9	-1.3	-0.9	-0.2	22.0	7.4	23.9	-0.3	15.4
Other Plants	-0.8	-1.2	-0.9	-0.2	22.0	7.3	24.4	-0.1	12.0
Livestock	-0.6	-0.9	-0.9	-0.1	23.4	6.6	23.8	0.0	13.9
Raw Milk	-0.5	-0.6	-0.7	0.0	18.3	4.6	20.2	0.0	11.9
Fish	-1.0	-1.6	-1.0	-0.2	16.7	7.6	21.9	-0.3	11.4
Meat	-0.5	-0.7	-0.7	0.0	21.4	6.0	20.4	0.1	12.5
Vegetable Oils	-0.5	-0.7	-0.9	0.0	22.4	6.9	26.9	0.0	13.9
Dairy Products	-0.3	-0.5	-0.6	0.0	19.7	4.3	21.9	0.2	10.3
Processed Rice	-0.6	-1.0	-0.2	0.0	20.8	2.8	8.0	0.0	6.6
Processed Sugar	-0.6	-1.0	-1.0	-0.2	22.8	8.0	26.0	-0.3	13.6
Beverages	-1.1	-0.9	-1.1	0.2	29.9	14.3	39.2	0.3	21.6
Other Food	-0.5	-0.6	-0.6	0.0	21.8	7.2	25.5	0.1	11.8
Industry	-1.3	-1.2	-1.2	0.2	4.3	1.3	9.8	0.4	2.6
Services	-1.2	-1.0	-1.1	0.2	4.2	1.1	10.4	0.4	2.5

Source: Own Calculations

Food demand increases strongly in AFRICA, ASIA1, and ROW while LATIN shows a moderate growth. The results indicate a tendency to consume more processed food. The reason for that is the application of the non-homothetic CDE function. The increases in the regional incomes facilitate higher consumptions of non-food commodities. For example, in the region ASIA1 the private household consumes over 10 percent more service goods.

The differences between the quantities demanded by the private household and the quantities produced (Table 4) show clearly that the regions AFRICA, LATIN, ASIA1, and ROW increase their food imports. Nevertheless, produced food quantities also increase in all four regions. Furthermore, the agricultural production in the OECD countries increases up to 15 percent (paddy rice in the EU, Table 4).

Table 4: Changes of Produced Quantities in Percent

Sector	EU	NAFTA	rOECD	TRANS	AFRICA	LATIN	ASIA1	ASIA2	ROW
Paddy Rice	14.9	5.4	0.4	1.2	19.4	3.9	5.6	1.0	7.0
Wheat	3.1	6.9	5.0	0.6	4.1	2.0	5.3	0.5	1.2
Other Cereals	2.6	1.3	2.2	1.0	8.7	2.5	4.2	0.6	1.1
Oil Seeds	3.7	5.4	4.0	3.2	9.8	2.1	10.5	2.9	5.3
Sugar Beet/Cane	4.8	1.8	3.4	2.6	14.6	5.6	14.7	3.3	9.2
Other Plants	4.7	2.8	1.9	2.4	8.4	2.6	3.3	1.4	4.0
Livestock	0.9	0.2	2.4	0.0	14.2	3.6	10.6	0.1	6.1
Raw Milk	0.5	-0.2	0.6	0.1	12.5	3.6	14.9	0.2	7.2
Fish	1.1	2.5	1.2	0.9	11.5	3.7	12.8	1.3	6.6
Meat	0.4	-0.2	0.7	-0.3	13.4	3.9	3.7	0.1	7.8
Vegetable Oils	2.2	3.5	1.1	1.7	8.0	3.9	1.8	6.6	5.9
Dairy Products	0.6	-0.3	0.8	0.0	10.9	3.4	8.8	0.0	4.0
Processed Rice	6.7	17.2	0.4	1.3	20.2	3.1	0.8	1.2	7.9
Processed Sugar	6.3	1.9	3.6	3.5	14.3	6.8	15.5	4.7	9.1
Beverages	0.3	-0.2	-0.8	-0.1	18.4	9.7	25.6	0.6	16.0
Other Food	1.6	0.6	0.8	0.4	13.2	4.5	-6.9	1.1	6.9
Industry	0.7	1.0	0.8	-0.2	-7.5	-2.3	-9.1	-0.6	-3.3
Services	-0.4	-0.4	-0.4	0.0	-0.2	0.1	1.4	0.1	0.5

Source: Own Calculations

In terms of price changes the simulation shows modest changes in OECD countries and the regions TRANS and ASIA2 (Table 5). Prices change much more strongly in the regions AFRICA, LATIN, ROW, and especially in ASIA1. The reason for that are the factor markets. Since the endowment is

constant during the simulation, an increase in production leads to higher factor prices. For example, the rental fee of land doubles in ASIA1 (Table 5).

Table 5: Changes of Prices in Percent

Sector	EU	NAFTA	rOECD	TRANS	AFRICA	LATIN	ASIA1	ASIA2	ROW
Land	14.5	14.7	8.8	8.4	73.8	20.6	99.5	6.8	44.3
Labor Unskilled	-0.7	-1.2	-0.9	-0.2	6.2	2.5	9.2	0.0	2.4
Labor Skilled	-1.0	-1.4	-1.0	-0.3	4.4	2.5	5.6	-0.2	2.0
Capital	-0.9	-1.3	-1.0	-0.3	4.8	2.6	4.6	-0.2	1.7
Paddy Rice	1.4	2.0	0.8	1.5	11.4	5.1	35.3	2.1	14.7
Wheat	0.3	1.7	0.8	0.9	9.8	5.5	30.4	1.4	9.7
Other Cereals	0.3	1.0	0.6	0.9	11.0	5.6	37.6	1.5	11.3
Oil Seeds	0.6	1.7	1.5	2.0	11.0	5.7	40.5	2.2	15.7
Sugar Beet/Cane	0.4	2.0	0.6	1.7	9.9	5.2	42.7	2.9	16.1
Other Plants	0.5	1.6	0.7	1.4	10.5	5.2	37.3	1.7	13.5
Livestock	0.2	0.5	0.4	1.1	10.0	5.5	39.1	1.5	9.6
Raw Milk	0.3	0.5	0.5	0.7	11.0	5.9	44.0	1.5	12.3
Fish	1.4	3.9	1.6	1.7	51.2	12.0	55.5	2.8	20.2
Meat	-0.2	-0.1	-0.1	0.7	7.9	4.4	26.3	1.1	5.8
Vegetable Oils	-0.3	0.6	1.1	0.8	7.3	3.8	21.5	1.2	6.3
Dairy Products	-0.3	-0.4	-0.4	0.3	6.4	3.8	16.2	0.5	7.1
Processed Rice	1.3	-0.3	0.4	0.5	8.8	3.5	27.2	1.2	8.5
Processed Sugar	-0.2	0.5	0.7	0.8	7.0	3.5	24.6	1.5	6.5
Beverages	-0.6	-1.0	-0.5	0.0	5.5	2.8	16.0	0.5	3.4
Other Food	-0.3	-0.6	-0.1	0.5	7.8	3.4	16.8	1.0	5.1
Industry	-0.7	-1.1	-0.9	-0.3	3.8	2.1	5.3	-0.1	1.4
Services	-0.8	-1.3	-0.9	-0.3	4.6	2.4	6.2	-0.1	1.8

Source: Own Calculations

5 Discussion

The advantage of the suggested approach is the ability to simulate a world without hunger and to estimate the cost of its achievement.

In addition to the very idealistic specification that OECD countries are willing to finance the elimination of the prevalence of food inadequacy, this analysis is based on a number of simplistic assumptions:

The GTAP 5 database refers to 1997. The increase of the world population since then is not taken into consideration. Furthermore, no technical progress is assumed to have taken place since then in the analysis. Also, while it is possible to introduce a tax in OECD countries it may be very difficult

to actually distribute the money in the receiver countries. To ensure that the money is handed over to the undernourished the development and maintenance of special institutions is necessary, which is in itself very costly. This means the total of the necessary financial transfer is underestimated. Furthermore, it may be very difficult to reach those suffering from war as well as malnutrition. Another issue, which has to be considered, is the possibility of corruption. Finally, protein supply and trace elements are almost as important as pure energy intake and should be taken into consideration too. In a further step it would be necessary to incorporate them into the model.

6 Conclusions

In this paper a general income tax is introduced to OECD countries in order to finance worldwide adequate nourishment.

Despite some simplistic assumptions the analysis shows clearly that the tax rate would be small. 0.83 percent would be sufficient to provide 800 million hungry people with an adequate calorie supply. In absolute numbers, the necessary transfer of 167 billion USD is modest compared to the 232 billion USD, which were spent by the OECD countries in 1997 on domestic support for their agricultural sectors alone (OECD 2001, p. 53).

The receiver countries would increase their domestic production as well as augment their food imports. In the OECD countries agricultural production would increase moderately while the prices of agricultural goods would rise slightly. This indicates that it is impossible to stimulate demand for agricultural goods in OECD countries noticeably through transfer payments to country with an insufficient calorie supply. Finally, the idea to support the agriculture in OECD countries indirectly through transfer payments to countries with a prevalence of food inadequacy instead of the present agricultural policy measurements is illusory.

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[13] http://apps.fao.org/page/collections?subset=nutrition

Appendix

Table 6: Detailed Outline of the Aggregation

GTAP-Region			Aggregation	GTAP-Region			Aggregation
31	AUT	Austria	EU	54	MAR	Morocco	AFRICA
32	DNK	Denmark		55	XNF	Rest of North Africa	
33	FIN	Finland		56	BWA	Botswana	
34	FRA	France		57	XSC	Rest of the South African Customs Union	
35	DEU	Germany		58	MWI	Malawi	
36	GBR	United Kingdom		59	MOZ	Mozambique	
37	GRC	Greece		60	TZA	Tanzania	
38	IRL	Ireland		61	ZMB	Zambia	
39	ITA	Italy		62	ZWE	Zimbabwe	
40	NLD	Netherlands		63	XSF	Rest of southern Africa	
41	PRT	Portugal		64	UGA	Uganda	
42	ESP	Spain		65	XSS	Rest of sub-Saharan Africa	
43	SWE	Sweden		21	XCM	Central America and Caribbean	LATIN
44	BEL	Belgium		22	COL	Colombia	
45	LUX	Luxembourg		23	PER	Peru	
18	CAN	Canada	NAFTA	24	VEN	Venezuela	
19	USA	United States		25	XAP	Rest of the Andean Pact	
20	MEX	Mexico		26	ARG	Argentina	
1	AUS	Australia	rOECD	27	BRA	Brazil	
2	NZL	New Zealand		28	CHL	Chile	
5	JPN	Japan		29	URY	Uruguay	
6	KOR	Korea, Republic of		30	XSM	Rest of South America	
46	CHE	Switzerland		10	PHL	Philippines	ASIA1
47	XEF	Rest of EFTA		12	THA	Thailand	
48	HUN	Hungary		13	VNM	Vietnam	
49	POL	Poland		14	BGD	Bangladesh	
52	TUR	Turkey		15	IND	India	
50	XCE	Rest of the Central European Associates	TRANS	16	LKA	Sri Lanka	
51	XSU	Former Soviet Union		3	CHN	China	ASIA2
				4	HKG	Hong Kong	
				7	TWN	Taiwan	
				8	IDN	Indonesia	
				9	MYS	Malaysia	
				11	SGP	Singapore	
				17	XSA	Rest of South Asia	ROW
				53	XME	Rest of the Middle East	
				66	XRW	Rest of the world	