Meat versus Malnutrition

An economic and ethical approach of scarcity in relation to purchasing power and malnutrition

Bachelor Thesis
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Picture on the cover by Mike Wells
Winner of the World Press Photo 1980
Uganda, April 1980. Starving boy and a missionary

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1. Introduction

More than 800 million people are undernourished while the word produces enough food to feed 12 billion people. One of the reasons for this is that a huge parts of the world food production is fed to animals. The Western world feeds 70% of its cereals to animals to produce meat. Meat has a significant lower nutritional value than the food that is needed to feed the livestock. Western consumers compete on the free market against the malnourished who have low purchasing powers and are barely able to register their basic need on the market. The free market allocates food to the highest bidder. The bidder is not necessarily the person with the highest need for the product. Due to the wants of the rich the poor are less or unable to get more than the subsistence level. Is this an acceptable result of *the invisible hand*? Several ethical theories are applied to determine whether it is not. And who should take action? Is this the responsibility of individuals or of the government? And how should this 'problem' be addressed?

> **Research Question:**
> *Does the consumption of meat and biofuels by affluent consumers create higher prices for food products which cause (more) malnourishment for poor people (in developing countries)?*
> *Which actors should take action to solve this externality (consumers or the government) according to several ethical theories?*

Part one answers the first question. Sen's theory is used to give a theoretical background to relate (a shift in) food prices to malnourishment. Then this is linked with the production of meat which requires masses of cereals. Meat consumption might increase prices in such a way that the malnourished are not able to get to the subsistence level. This is analyzed with a long term aggregate demand-supply model. The model is based on empirical data and is used to examine whether tempering the meat consumption leads to a drop in malnourishment. Part two answers the second question whether the government and/or individuals have a responsibility to induce a drop in cereal prices by policy or behavior in order to diminish malnourishment. Four ethical theories are addressed to provide an answer to this question.

Part 1 Meat consumption, biofuels, food prices and malnourishment

2. General information

a. Undernourishment

According to preliminary figures from the Food and Agricultural Organization of the United Nations (FAO, 2006a) 861,6 million people were undernourished during the period 2002-2004. A person is called undernourished if he is not able to function or develop properly due to a lack of food. In the present situation this is still a major problem for a large part of the world population. In December 1990 192 United Nation countries (Sachs, 2005) declared that they will try to achieve 8 goals by the year 2015, the so called millennium development goals. Goal number one is to eradicate extreme poverty and hunger. This goal has two targets. The first is halving the number of people living on less than a dollar a day and the second target is halving the proportion of people who suffer from hunger.

b. Purchasing Power

Amartya Sen (1981) showed in his book *Poverty and Famines: An Essay on Entitlement and Deprivation* that famines are not caused by a lack of food but are the result of inequalities built into mechanisms for distributing food. Food distribution is determined by purchasing power. Two import aspects are the price ratio and endowment. According to Sen, people can be plunged into starvation by (1) a collapse of his or her endowment bundle or by (2) an unfavorable shift in the exchange entitlement mapping. In this thesis I will primarily focus on the effect of a change in the price ratio which can cause an insufficient purchasing power to meet the subsistence level.

Figure 1 shows the theory of Sen in a graphical way. The amount of food for a person to stay alive is the distance between O and A. With the given price ratio B the minimum required income to stay alive is the triangle OAB. If the endowment of a person is above the line BA that person is able to collect a sufficient amount of food to stay alive. If the endowment with the given prices is lower than the line BA a person is not able to gather enough food and starves if the situation continues long enough. If the endowment bundle collapses (1) a person can get less than the subsistence line. This can be visualized

in the graph as a shift from point x to point x* which is below the subsistence line BA. Another possibility is an increase in the food price that can be visualized by a shift from p to p*. with the result that a person plunges into starvation.

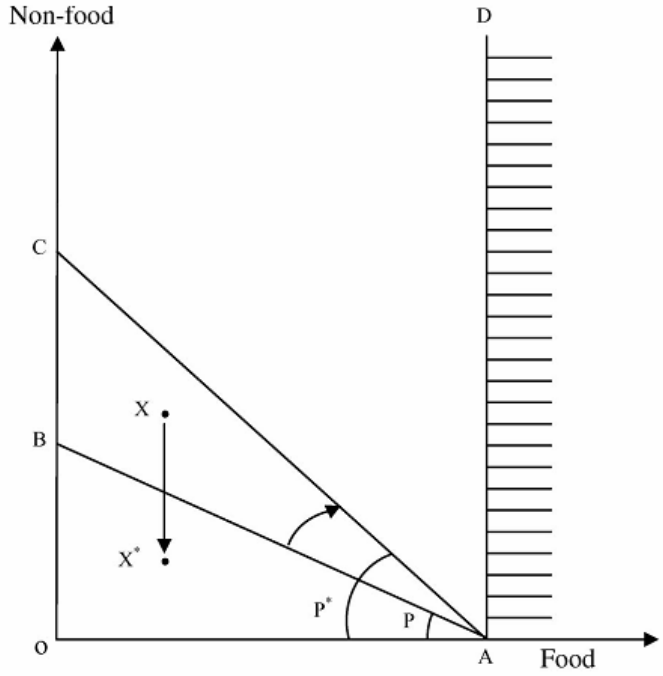

Figure 1. Illustration of endowment and entitlement

(Source: Sen (1981))

Sen showed that the Bengal famine of 1943 was not caused by a lower than normal harvest, but was triggered by higher demand from other regions. Due to this, food prices increased and many people faced such heavy deterioration in purchasing power that they simply starved to death. People's income stayed the same, only the price of food increased. As a result, they were less able to buy food. In many cases the deterioration was so large that they got below the subsistence level. The demand from other regions increased the prices in Bengal. In other words, Bengal became an exporter of food while it suffered from a famine. This also happened during the Irish Potato Famine (Wikipedia, 2007a). Local population starved to death while Ireland was exporting potatoes to England.

Presently the world globalizes further. Transportation cost decline substantially with the result that goods and food can be exported over greater distances than in the past. Purchasing power from one part of the world influences the price ratio on the other side of the world. World food prices are nowadays much tighter connected and consumers from

developed countries compete with consumers from developing countries for the same commodity, namely food. In the past this caused famines and due to globalization the global competition got even more severe.

c. Meat production / consumption

One quarter of the world's meat production depends on natural system-rangelands. Most of those places are too arid or too steeply sloping to be plowed. Meat production is the only economical way to use the land. Besides the rangelands there is also cropland. The crops from this land can be consumed by humans directly; cereals like maize, wheat, rice and barley. Other than using it for direct human consumption the cereals can also be used to produce meat. In this way ¾ of the meat is produced. In 1998 36% of the world's grain went to feed livestock and poultry (Worldwatch Institute, 1998). Producing meat costs a lot of cereals (see Table 1).

Needed plant-derived Calories	To produce 1 Calorie of….
11	Beef
11	Mutton
4	Pork
4	Poultry
8	Milk
4	Egg

Table 1: Cereal intensity of meat. Source: FAO (1996b)

According to scientists from Cornell University (Pimentel, 1997) animal protein is only 1.4 times more nutritious than a comparable amount of plant protein. Eating plant protein is always more efficient than using animal protein. The developing world feeds 21% of its grain to livestock, in the developing world this number is 70%. The livestock in the US consumes five times more grain than is consumed by the population directly. If Americans (Pimentel, 1997) shift to lower meat consumption and only consume meat which is produced with the use of rangelands, America would still produce enough protein to feed its population with the recommended daily allowance. The cereals can be used to feed 800 million people. There are huge differences in the meat consumption between countries. Roughly developed countries consume 3 times more meat than developing countries (72 kg versus 24 kg per person per year).

d. Other recent developments

Their are also other developments that might influence the demand for cereals in the future. Biofuels and the Engel curve of meat consumption are presented in the following two paragraphs.

i. Biofuels

Many countries increase the amount of land dedicated to the production of biofuels for fuelling cars and other vehicles. In the United States the demand for corn to produce bio fuels has already driven up the price of corn (The Economist, 2007). As more and more land is used to produce biofuels the price of soy and other food crops also increase. Besides the consumption of meat the malnourished might face more competition if they also have to compete against the demand for energy. This scenario is not unlikely, because the fossil oil reserves are drying up and the use of fossil fuels leads to the emission of carbon dioxide.

ii The Engel curve of meat consumption

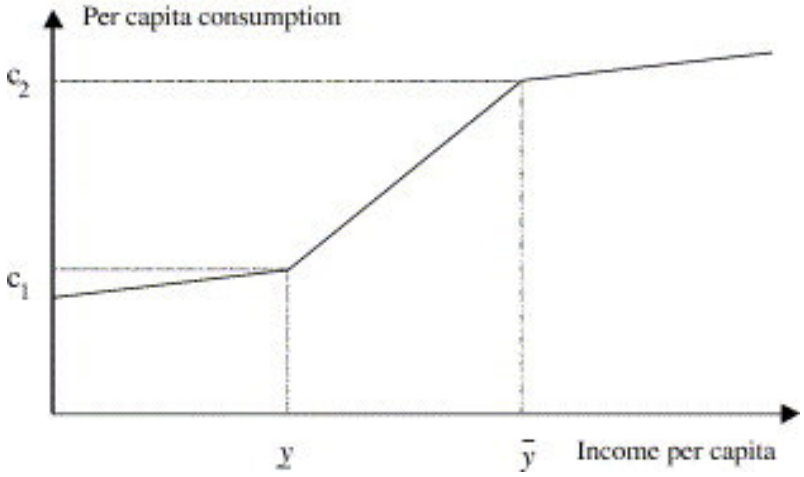

Figure 2: Threshold value for meat consumption.

According to Keyzer (2005) a couple of big countries such as China are just breaking through the income level where the meat consumption rises faster. For this group the meat consumption as a percentage of income per capita rises steeply till the saturation income level is reached where the growth of meat consumption declines again. This is visualised in figure 2. In Figure 3 the price elasticity of cereals / bread and meat are displayed in a scatter plot. Wealthier countries have lower elasticities than poorer countries; poorer countries have higher price elasticity for meat than for cereals. Therefore, wealthier

countries are concentrated in the upper right corner and the poorer countries are located in the lower left corner. The consumption of cereals in poor countries rises with 5% if the price drops 10%. Wealthy consumers have a lower price sensitivity. Meat consumption has a higher price elasticity. For low income countries this is close to -0.7 and for the rich it is close to-0.1.

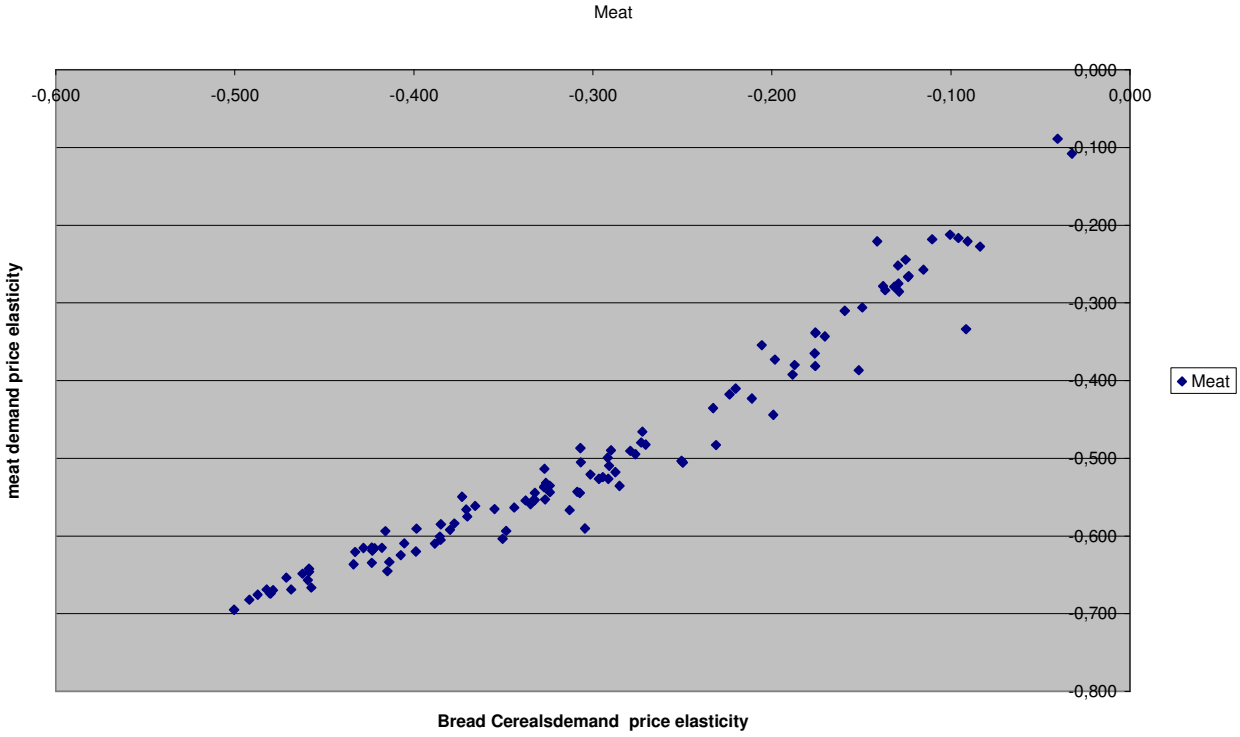

Figure 3: Price elasticity of bread and cereals versus the price elasticity of meat (USDA, 2003)

3. Long Term aggregate supply elasticity

a. Theory

Only if the price of food drops due to lower meat consumption the purchasing power of the malnourished rises and they will be able to come closer to the subsistence level or even above it. The question is: Does a decline in meat consumption lead to a lower price of food on the long term? In the short term the supply elasticity is close to zero. Mamingi (1996) points out that our understanding of the long-run aggregate supply elasticity is very weak, while this knowledge is essential to understand the agricultural supply response on the long run. The elasticity of agricultural supply responses can be analyzed in different ways; it is

possible to analyze sub-sectoral output, a specific crop or aggregate output. A model that is used to calculate the long term production is often the Nerlove model. This model is a dynamic model that explains output as a function of price and several other exogenous variables. Exogenous variables are for example, credit, mechanization, land reform, research, irrigation, weather, and soil quality. Another important aspect to consider is that the supply response is not necessarily symmetric; supply can react differently to a price increase and a price decrease. Production facilities are fixed assets which are acquired with certain costs. If prices drop they are not thrown away, at least not in the short run. Data pooling is also a problem when one tries to calculate elasticities. Improper pooling of non-comparable data can blur the results. Moreover, also prices and exchanges rates are not easily comparable across countries.

b. Empirical findings

Empirical studies (Mamingi, 1997) find firstly that the individual crop elasticity is larger than that of aggregate output. This makes sense, because one crop is replaceable for another. Secondly, the short run elasticity is smaller than the long run elasticity. Sijm (1997:555) gives an overview of several studies who present long term aggregate supply elasticities and found an average value around 0.2. According to Petersons (1988) the long run aggregate agricultural supply elasticity is in the neighborhood of one. Peterson's results are calculated with Cross-country data and his values are likely to be incorrect. The aggregate supply elasticity in his sample is larger than the individual crop elasticity; this should be the other way around. Secondly Binswanger (Sijm, 1997:556) found with Peterson's data a negative supply elasticity after adding dummies to control for country specific characteristics. Cross-country calculations face problems in determining the price elasticity. Kere (1986) found an elasticity for Kenya over the time period 1965-1983 of 1.38. Jaforullah (1993) found respectively a short term elasticity of 0.15 for falling prices and 0.32 for rising prices. For the long run he finds 0.20 respectively 0.41. Bloom and Sachs (1998) especially focused on Sub Sahara Africa and find that both price elasticity and non-price elasticity are low due to low soil fertility and low and irregular rainfall which act as binding constraints. We can conclude that the long run elasticities are larger due to changes in the input factors for production. Our understanding of the supply response elastic is weak and further research should be on the academic agenda to provide more reliable answers.

c. Arable land

Producers can increase or decrease their production if they change the inputs of the production. If the demand for food rises in the future, new soils can be taken into production. The FAO expected that half of the increase of the production would be reached by an increase in the number of acres (Veen, 1993). Stolwijk is skeptical about the possibility to increase arable land. The new potential arable land is often of a lower quality than present arable land. Moreover, it is often sensitive to soil erosion which makes it not an optimal long term investment opportunity. Most potential arable land is covered by tropical rainforest. Bringing this in production can cause a great harm to the environment (Fischer, 1991).

4. Market Outcome

The free market does not make a distinction between basic needs and wants (Graafland, 2007:384). The market is simply ruled by purchasing power; if the purchasing power of person A is greater than that of person B he or she can register a greater need and acquire a certain product. The market legitimizes the unlimited demand of the rich over the invisible demand of the poor. Food is nowadays a commodity which is sold to the highest bidder who can be anywhere in the world; on every continent in every country. During the Irish Potato famine, food was shipped to England because the English had a higher purchasing power. The same is happening now but over much larger distances due to lower transportation cost. In Brazil more than ten million people (FAO, 2006a) suffer from malnutrition, while this country exports livestock feed to developed countries to feed their animals. Secondly, millions of hectares of fertile soil are used to produce ethanol which is used to power Brazilian cars. The inputs, e.g. water and soil, for the production of ethanol cannot be used for food production. Achterhuis (1988) mentions in his book the Brazilian economist Datta who calls it a crime that fertile soil is used to produce food for cars while two third of the population is undernourished. The effective purchasing power of meat consumers and car owners is higher than that of people below the subsistence level. There is no difference in the free market between basic needs such as a subsistence food level for poor Brazilians and the want for meat consumption in the developed world or for driving vehicles by upper class Brazilians. The same mechanism of the market worked during the Bengal and Irish famines and shifted the price ratio in such a way that people where not able to buy enough food to get the subsistence level. In a free market allocation is just a matter of the wants of people with relatively high purchasing powers.

5. Tempering the consumption of meat: a explorative analysis of the consequences

a. Categorization of users and use

A supply and demand model is used to determine whether a lower autonomous demand of the developed world leads to lower food prices. To calculate this total demand is split up into three groups;

- non-malnourished in the developing world (3785.74 million) ; referred to as the poor
- malnourished in the developing world (757.90 million) ; referred to as the malnourished
- population of the developed world (1175.4 million) ; referred to as the rich

	Food for direct human consumption & other uses[b]	**Feed for livestock**[b]	**Total**[b]	**Population In millions** [a]	**Total use/ Pop**
Poor	673	313	986	3785,74	0,26
Malnourished[c]	123	0	123	757,90	0,16
Rich	313	430	743	1175,40	0,63
Total	**1109**	**743**	**1852**	**5719,04**	**0,32**

Table 2 Specification of use and users of cereals

[a] Medium variant 1995-2000 ; source ESA UN (2007)

[b] World cereal utilization by use 1996/1997 FAO (1997)

[c] I assume that the poor do not consume meat.

The rich uses 430 metric tonnes of cereals to feed their livestock. The model calculates the impact of a 29% decrease of the autonomous demand of cereals of the developed world. This is equal to a 50% drop in meat production from this group.

b. A simple model

The model has eight exogenous variables; 4 price elasticities, the autonomous demand for the 3 groups and the total autonomous supply. This leads to an equilibrium with a certain

price where demand is equal to supply. Equilibrium prices are calculated with the computer program Matlab. Every set of endogenous variables had to be manually entered into the program. For this reason only a limited set of endogenous values has been explored.

value*	variable	Description
-0,1	er	price elasticy rich
-0,35	ep	price elasticity poor
-0,6	em	price elasticity malnourished
0,2	es	price elasticity supply
* the values given are used as initial values, later calculations with other values are examined as well.		

Table 3: Model values

Equations

(1) demand rich = autonomous demand rich * p^{er}

(2) demand poor = autonomous demand poor * p^{ep}

(3) demand malnourished = autonomous demand malnourished * p^{em}

(4) supply = autonomous supply * p^{es}

(5) supply = demand rich + demand poor+ demand malnourished

The model exists of the above given 5 equations.

c. Explanation of chosen values

The long term aggregate supply is estimated at 0.20 and is based on an overview over several empirical studies by Sijm (1997), his results can be found in appendix A. The demand price elasticity of the rich is estimated at -0.10 which is derived from figure 3. Rich countries have a low elasticity. Figure 3 also shows that poor countries have a price elasticity of -0.50. The extremely poor people are expected to have a price elasticity which is close to minus one (UN, 2007). For my calculations I used the value -0.60 for the malnourished which might be too inelastic. The last group are the poor non-malnourished in the developing countries. For a group of 85 developing countries the average price elasticity is -0.35. This value is not corrected for population size. Because price elasticity data are scarce the malnourished are included in this number. The malnourished have a higher elasticity and therefore the number is likely to be an overestimation of the real number. All values are conservative estimations; due to this the drops of the cereal price as well as the drop in malnourishment are conservatively calculated with this model.

d. Does a drop in meat consumption has an influence on malnutrition?

A decline of 27% of the cereal demand by the rich leads to a 22% lower price as is displayed in table 4. Because the long term aggregate supply elasticity is relatively low the supply drops with only 5%. The poor will consume 9% more cereals and the consumption of the malnourished increases with 16% to 143 metric tonnes. The FAO (2000) has estimated the average food deficit of the undernourished in kcal/person/day for each country. I calculated an increase of the demand by the malnourished of 16% independently of the degree of malnourishment. In practice the price elasticity of the demand can be expected to be higher if the degree of malnourishment is higher and visa versa. The increase of consumption will be higher for the poorer people than for the relatively richer (former) malnourished. According to my calculations 258.5 million people will escape malnourishment (Appendix B). The other 499.4 million malnourished people will experience an increase of consumption of at least 224 kcal a day, which is approximately 12% of the minimum daily energy requirement. An underlying assumption in the calculations is that all undernourished people are as undernourished as the average undernourished person in each country. This assumption does not hold in reality and the number of people who escape malnourishment can be greater of smaller depending on the distribution of the calorie deficits among the malnourished population.

There are several ways to lower the demand for cereals. One of them is to diminish meat consumption, but we should not forget other options that are also feasible. For example, it is also possible to substitute a type of meat for different types that need less plant-derived calories. Poultry and pork almost need three times less plant-derived calories as beef. A huge drop in cereal demand can be relatively easily accomplished in this way.

	autonomous demand rich	autonomous demand poor	autonomous demand malnourished	autonomous supply	price	demand rich	demand poor	demand malnourished	supply
Present situation	743	986	123	1852	1,00	743	986	123	1852
50% drop rich meat consumption	528	986	123	1852	0,78	541	1077	143	1761
in % of Present situation	-29%	0%	0%	0%	-22%	-27%	9%	16%	-5%

Table 4: Results with initial assumptions.

e. Sensitivity to different assumption

In the following paragraph parameters are changed and the results are given how this affects the equilibrium price and the demand of the malnourished.

change in variable	value	Price change (%)	demand malnourished	consumption increase % malnourished	number of people in millions who get out of malnourishment
price elasticity poor	-0,35	-22	143	16	258,5
	-0,21	-26	148	20	596,3
	-0,05	-33	156	27	739,1
price elasticity malnourished	-0,80	-22	149	21	626,7
	-0,60	-22	143	16	258,5
	-0,40	-23	136	11	12,9
price elasticity supply	0,00	-34	158	29	749,6
	0,20	-22	143	16	258,5
	0,40	-16	137	11	15,1
price elasticity rich	-0,40	-19	140	13	55,8
	-0,10	-22	143	16	258,5
	0,00	-24	144	17	277,2
autonomous demand rich	743	0	123	0	0
	583	-17	138	12	19,3
	463	-28	150	22	626,7

Table 5: Results with other assumptions

i. price elasticity of the poor

Table 5 shows the effect if the price elasticity of the poor changes. A more inelastic elasticity leads to lower prices if the autonomous demand of the rich drops and hence the consumption of the malnourished poor increases. If the price elasticity of the poor shifts from -0.35 to -0.05, the consumption of the malnourished increases with 9%. From the status quo situation the consumption increases with 26%. This group consist out of 3.8 billion people. Hence, a lower elasticity has a large effect on malnourishment, as the

elasticity of 0.05 also shows. If we assume an elasticity of 0.21 malnourishment drops severely. Therefore we can conclude that with a realistic elasticity of 0.35 the suffering of millions will end.

ii. price elasticity of the malnourished

How does the price elasticity of the malnourished influence the demand of the malnourished? With the initial assumption the demand increases to 143 MT. If we set the price elasticity on -0.80 the demand increases further till 149 MT. Lower price elasticities leads to a drop in demand, for the value -0.05 this results in a 7 units decrease till 136 MT. Variation in this parameter influences the amount of malnourishment significantly. It is very likely that the elasticity is at least lower or equal to -0.5. Thus diminishing the cereal demand has a large impact on malnutrition and higher elasticities of the malnourished leads to further elimination of malnourishment.

iii. price and autonomous demand from the developed world

What is the relation between the autonomous demand of the rich world and the demand of the poor? If the autonomous demand of this group decreases malnourishment also decreases. In fact, a change in this value triggers the end of malnourishment. But the demand should drop significantly to have an impact on malnutrition. A drop of 37% of the autonomous demand leads to the end of malnourishment for 626.7 million people.

f. implicit assumption of the model

The model is a simple abstraction of the complicated world cereal market and a couple of assumptions are made. I will sum up three of them:

Transportation costs — Transportation cost are assumed to be zero. In the areas where most malnourished people live, infrastructure is very weak or virtually non-existing and transportation cost might be significant.

Equally malnourished — All malnourished citizens are assumed to be equally malnourished to calculate the number of people who will escape malnourishment. If the distribution of the calorie deficit is unequal, the number of people who will escape malnourishment will be lower. However, not only the number of malnourished people matters, also the

degree of malnourishment is an important factor. If the degree can be lowered, this also improves the live of people to a great extent and improves their functioning's and lowers their suffering.

Influence on income

Malnourished people might not only be consumers of cereals but may also be producers, or there income might depend on production. Farmers and peasants can also be malnourished; a drop in cereal prices diminishes their income. Purchasing power of those groups will not increase and might even decrease severely. The model neglects this possibility.

Part 2 Which actions should be taken?

6. Which actors can take action?

In the preceding chapter I argued that the indirect demand for cereals requested by meat consumption and the demand for biofuels causes higher cereal prices and therefore malnutrition in developing countries. This externality is unintentionally caused by the aggregate demand of all consumers. Every individual consumer has not the intention to create higher cereal prices which cause starvation for the poor people of this world. In this chapter I am going to analyze how the various actors can take action to this problem and can act in a way that will not cause the externality or whether the externality can be neutralized by a second action. Firstly, I will focus on the potential role of individuals and secondly I will discuss the possibilities for potential government intervention to solve the discussed problem. For all those actors I will try to find an answer whether it is possible for them to solve the problem. In the next chapter several ethical theories are applied to determine whether those actors should take action. In all theories I assume that the price of food will fall.

a. Individuals

In his famous book the Wealth of Nations Adam Smith (1776) presents the idea that the common interest is served best if everybody pursues his or her own interest. This is shortly presented in the following quote:

> "*"He (the businessman) generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. .. . He intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain. He is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. ... By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.*"
>
> (Smith, 1776; 351-2).

The producers only want to earn a living and to do so they produce for the market which leads to greater supply and lower prices. Due to the lower prices the products come into reach of the purchasing possibilities of even the poor. The invisible hand serves the interest

of all. The above given example focused on an increase of the supply side, while chapter 5 made clear that the possibility for the poor to exceed the subsistence level of food is troubled by the excess demand of the rich. Smith also wrote a book (Smith, 1759) about how moral sentiments go hand in hand with the market. Here he argues that .

> *"Nature, when she formed man for society, endowed him with an original desire to please, and an original aversion to offend his brethren. She taught him to feel pleasure in their favourable regard…. Nature, accordingly has endowed him, not only with a desire of being approved of, but with a desire of being what ought to be approved of; or of being what he himself approves of in other men. "*
> (Smith, 1759; 170).

People will automatically foster the happiness of others because of the feature of moral self-criticism and sympathy. In the case with purchasing meat consumers are not directly confronted with the effects, or they might not even be aware how their demand affects others. For the latter, consumers should just be informed about the consequences of their *excess* demand. If consumers are aware of the effects, then they should be aroused by sympathy for the results of there action and abstain. Or are the effects too far away for the consumers so that they are not touched by sympathy? Due to the globalization since the time of Adam Smith many transactions are across borders and consumers are not faced with the consequences of their demand. Direct sympathy is not aroused in consumers and indirect sympathy might have no effect at all.

Table 6 shows the number of vegetarians in six Western European nations. In all countries the percentage of vegetarians is low and varies from 0.2 till 6.1%, but in none of the countries a really substantial part of the population is vegetarian.

Country	**Vegetarians**	**Total Population**	**%**
France	500,000	56m	0.9
Germany	700,000	56m	1.25
Netherlands	700,000	16m	4.4
Poland	75,000	38m	0.2
Sweden	60,000	8m	0.75

United Kingdom	3,500,000	57m	6.1

Table 6: How Many Vegetarians? (IVU, 1995)

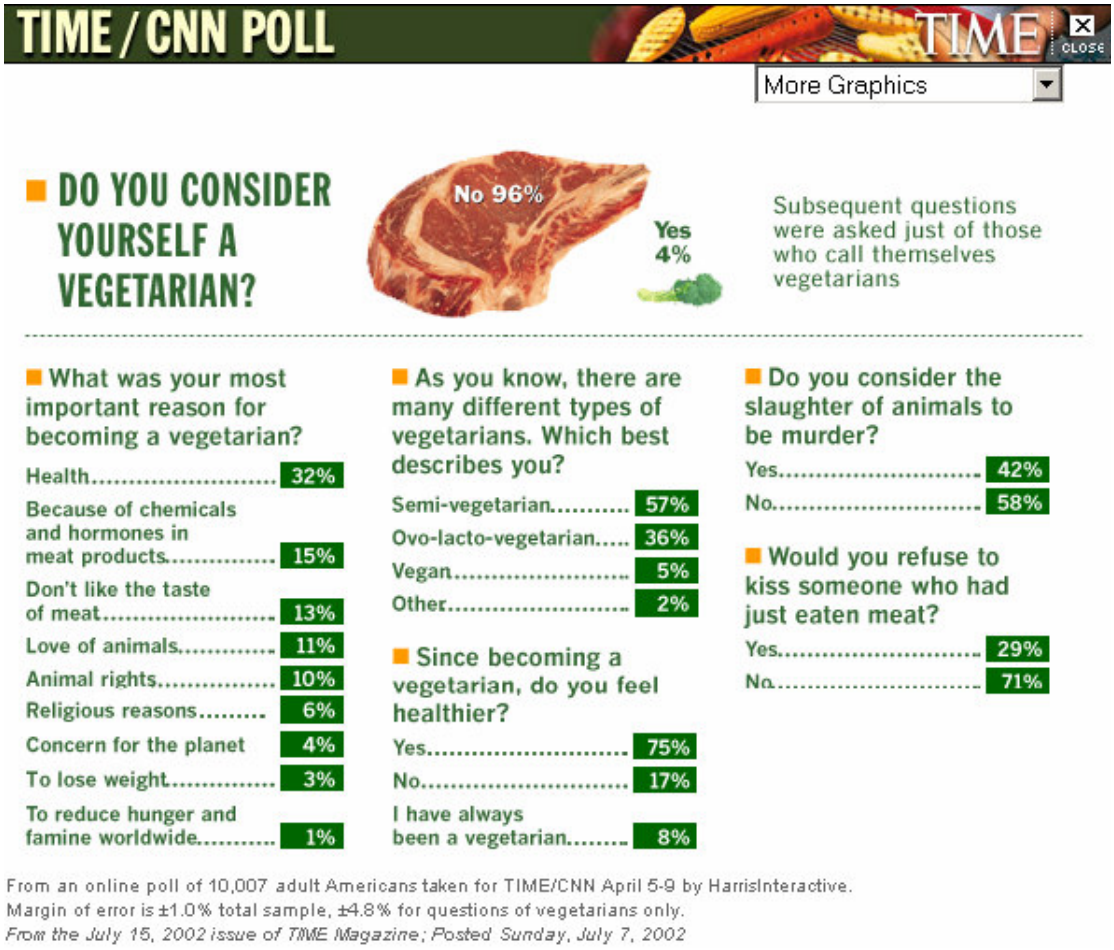

Figure 4: Do you consider yourself a vegetarian? ; (Time/CNN, 2002)

Time Magazine and CNN (Time/CNN, 2002) have performed a poll in 2002 to find out why people are vegetarian. In figure 4 you can find the results of this US poll. According to the poll 4% of the US adult population is vegetarian and the reasons are as diverse as you can find in the figure. One percent of the US adult vegetarians have as most important reason to be vegetarian to reduce hunger and famine worldwide, a small number compared to a number of other reasons. Besides becoming a vegetarian, it is also possible to diminish one's own meat consumption, but figures in this area are unknown as far as I know. There are no reasons to assume that the motive to end world hunger and famines worldwide is different for people who partly diminish their own meat consumption compared to vegetarians.

While the Western World shipped food as emergency relief to Sudan, this country exported its own food to the West (Het Parool, 26 October 1985). The same happened during the 'Live Aid' events when the West collected money for Ethiopia, while the country exported white beans to Europe to feed animals for meat production (NOVIB, 1986). This example indicates that (1) consumers do not have an overview of how the market works, (2) have the opinion that their unilateral decision has no influence on the aggravated level , (3) they do not care or (4) think that it is not their duty to help. Individual consumers sometimes have sympathy for the poor and give money to the victims of famines, although consumers do not link the problem with their own meat consumption. By giving money the core of the problem is not tackled, only the results of the actions are slightly lightened. Unfortunately, that does not solve the problem on a structural basis.

b. Government intervention

While there are undernourished people in the developing countries many developed countries face huge health care costs due to over-nutrition of food and in particularly meat. According to Barnard (1995) the total direct medical costs attributable to meat consumption for 1992 are estimated at a minimum of $28.6 billion and a maximum of $ 61.4 billion. Large parts of the costs are paid by governments or insurance companies. Wealthy nations and their citizens are burdened by the over-consumption of meat and face huge cost. Besides the undernourishment in poor countries meat consumption also leads to illness for the affluent, together we can call the problem malnourishment (UNICEF, 2007). The government of wealthy nations could introduce a tax on meat consumption. Goodland (1997) presented the following idea in order to protect the environment, but it will also have a positive effect on food prices and the purchasing power of the malnourished. Goodman means with conversion the rate between the amount of grain needed and the output in meat.

> *"The least efficient converters (pork, beef) would be highly taxed; more efficient converters (poultry, eggs, dairy) would be moderately taxed. Most efficient converters (ocean fish) would be taxed lowest. Grain for human food would not be taxed, while coarse grains might be modestly subsidized."*
>
> Goodland (1997)

Depending on the aggregate long-run supply elasticity the price for cereals would drop. The problem is that a country or block of countries must have a significant influence on the

price of food worldwide. For example, a country as the Netherlands where slightly more than 1% of the population of the developed world lives has no significant influence on the market price. Only if a larger part of the developed world diminishes its meat consumption the price ratio of food changes in favor of the poor and malnourishment diminishes.

The government is also able to solve the coordination problem between the consumers. A single consumer cannot alter market prices, but the government can decide to solve the coordination problem. The individual consumer might not diminish his meat consumption because his effort does not affect world hunger; only if others do the same it has an effect. The government can solve this problem with a tax-incentive. The total tax pressure in a country can stay the same if other taxes are diminished with the amount collected with this meat tax.

7. Evaluation with four ethical theories.

Four ethical theories are addressed with the question whether consumers should diminish their meat consumption and whether the government should take action so that the demand for cereal drops. Firstly, the issue is questioned from a utilitarian point of view. Secondly, Nozick's libertarian theory is applied. Next, the positive right ethics of Shue and the ethics of care by Goudzwaard and de Lange are examined. The theories are all introduced very briefly. For more information about the theories I refer to Economics, Ethics and the Market by Graafland (2007).

a. Utilitarianism

Velasquez (1998: 73) gives the following definition of utilitarianism: *"an action is right if and only if the sum of total utilities produced by that act is greater than the sum total of utilities produced by any other act the agent could have performed in its place."*

i. Individual

How should an individual act in order to maximize the total sum of utilities? How does meat consumption or abstaining from it, in total or to certain extents, influence *the greatest happiness for the greatest number*. To answer this question the utilities of all actors are summed in a situation in which consumers from developed countries diminish their meat

consumption and this is then compared with the status quo. If diminishing the meat consumption leads to a greater happiness, then a consumer should diminish its demand.

According to the calculations in chapter 5 an autonomous drop in cereal demand of 29% leads to a drop in prices due to which 258.4 million people will escape malnourishment and another 499.4 million under-nourished people will experience a daily kilocalorie gain equal to at least 12% of the daily requirement. On the other hand, consumers in the developed countries have to face a lower utility because they prefer the status quo meat consumption over the diminished new situation. Malnourished people still have a high marginal utility from each extra calorie they can extract from the extra purchased cereals. Due to the extra consumption their functionings improve and they do not longer have to suffer from the chronicle feeling of hunger. This is a huge utility gain. Meat consumers in the developed world already have a high utility and the marginal utility of meat consumption is relatively low. It is unlikely that 1175.4 million people appreciate meat consumption more than 757.9 million suffering malnourished people appreciate a 12% increase of their calorie intake. To conclude, it is very likely that according to utilitarianism theory the individual consumer has an obligation to abstain from meat consumption.

ii. Government

One of the tasks of the government according to the utilitarian theory is to maximize the greatest happiness for the greatest number. With the introduction of a meat tax the total tax pressure does not have to increase; other taxes can be lowered if the meat tax is introduced. The government can also solve the coordination problem between the individuals. According to the utilitarian theory the government should introduce a meat tax. A tax as proposed by Goodman would be suitable. Each type of meat can be taxed equal to a Pigouvian tax which is needed to avoid the externality (of malnourishment).

b. Libertarianism

Robert Nozick (1974) presents in his book *Anarchy, State and Utopia* his theory of justice. According to this theory the distribution of goods cannot be unjust if individuals can make a free choice (Graafland, 2007:209). The government is not allowed to tax its citizens to finance social programs. Justice according to Nozick consists only in just procedures and not in just or unjust outcomes. There are three procedural principles: Justice in acquisition, justice in transfer and justice in rectification. Justice is acquisition (1) deals with the

appropriation of unheld things. In our situation person A sells his product on the free market to person B. As long as both parties voluntarily agree (2) to transfer the product there is no injustice.

Thirdly, justice of rectification becomes relevant when at least one of the other two principles are violated.

i. Individual

An individual buyer of meat has no duty to consider the price increasing effect of his demand. As long as the justice in transfer is respected and both parties voluntarily agree to the transfer. We have no reason to doubt this; the meat consumer voluntarily buys, the livestock farmer sells voluntarily, and the cereal farmer also voluntarily sells his product. Hence, there is no injustice in the transfers because they are guided by the free market. Every individual can choose to give away his or her wealth to another party. All relative wealthy individuals can transfer resources from themselves to people who are malnourished as long as they do this voluntarily. All wealthy consumers can decide for themselves if they want to consume meat or not, they have the free choice to allocate their own resources in any way they want. A more equal allocation of resources makes a society not more just. The consumption of meat is, from Nozick's moral perspective just, as long as the justice of transfer is respected, as is the case with meat consumption.

However, if the seller of the livestock feed acquired his land in an unjust way this should be repaired. Information should be acquired about the present and the hypothetical present situation if the injustice did not occur. It might be possible that the land in the new world, such as the Americas, has not been acquired in accordance Nozick's acquisition principle. In that case the injustice should be rectified. This can be done by compensating the people whose right is violated. It is possible that due to the fact that in the past their rights are infringed, they are presently not able to collect enough income to get the subsistence level. However, the problem of malnutrition by itself cannot be attributed to this and can utmost be a side effect.

ii. Government

Nozick is in favor of the minimum state. The state should not perform social programs without the voluntarily consent of the individual, because to do so the government needs to tax its citizens. Taxes higher than a tax-rate needed for the minimum state infringe on people's property rights. What people have is determined by what they get from others who

give it to him in exchange for something else or as a gift (Graafland 2007: 209). The government is not allowed to tax meat consumption in order to make food more affordable to the malnourished. Furthermore, the state should not pay, for example, the medical costs of its citizens, because doing so will violate the property rights of others. The market works and the 3 basic principles of justice are not violated, so there is no role for the government in this situation.

c. Shue: positive right ethics

According to Shue (1996) it is necessary to have a certain level of minimal resources in order to be able to enjoy real freedom. Shue (Graafland, 2007:189) finds basic rights essential to enjoy other rights. Basic rights therefore should be established securely before non-basic rights can be secured. One of the basic rights is the right to a *minimum level of subsistence* or economic security. Shue includes cleanliness of air and water, adequate food, adequate clothing, adequate shelter and minimal preventive public health care (Graafland, 2007:190). If a peasant switches from the production of black beans to grow flowers for export the supply of black beans drops on the local market and the price may rise, which is bad for the poor consumers at the local market. A shift in production can have a profound effect on people's ability to survive. Graafland (2007: 191) gives the following abstract:

> *Amid a scarcity of food, the decision to grow flowers can cause malnutrition and death for others. This suggests that the Lockean proviso should also hold for transaction of property (and not merely for acquisition of unowned things).*
>
> *From the basic rights, Shue derives three types of perfect duties:*
>
> *(1) the duty to avoid depriving – one should not eliminate a person's only available means of subsistence;*
>
> *(2) the duty to protect from deprivation of the only available means of subsistence by other people*
>
> *(3) and the duty to aid the deprived by providing for the subsistence of those unable to provide for their own (Shue, 1996: 53)*

Source: Graafland (2007: 191)

i. Individual (1)

Individuals should respect the three perfect duties and therefore an individual should not perform an action if that action has a foreseeable depriving consequence for others. Hence, if meat consumption influences the price of cereals in such a way that less people get the

subsistence level, people should abstain or at least diminish their meat consumption in order to avoid elimination of the available means of subsistence of someone else.

ii. Government

In an imperfect world not everybody fulfills their first duty and some people's basic rights are harmed. Therefore institutions should make sure that the basic rights are not harmed. It can be the case that the harm is totally unintended and a by-product of the joint working of the aggravated choices of individuals. In these cases there is a collective responsibility to intervene. The institution can imply prohibitions or introduce incentives to internalize the externality. The incentive in our situation would be a (Pigouvian) tax on meat consumption so that the externality does not occur and the basic right is respected.

iii. Individual (2)

If not all individuals live up to their duties and the government or another institution does not protect the rights of others, the individual should aid the deprived to help them to the subsistence level. All individuals in the status quo have according to Shue the duty to provide aid for the people who live below the subsistence level with one's own means.

d. The ethics of care (Goudzwaard and de Lange)

Goudzwaard and de Lange agree with the analysis given in chapter 4, namely that neoclassical economics does not distinguish between needs and wants. The result is that the unlimited wants of the rich are legitimized and there is not much left for the poor who are unable to register their basic needs in the market. Economics should shift its attention to the real economic goals, namely providing sufficient care for human subsistence needs and the improvement of the development options especially in the third word (Graafland, 2007:384). This requires that the developed world accepts a responsibility to help the poor to reach a minimum provision of basic needs. The rich must be satisfied with a certain level of consumption and should not consume more than this level. Measures against or abstaining from consumption do not have to be necessarily negative for the West. Often over-consumption has negative effects on the society. An example is the over-consumption of food such as meat which leads to huge health care costs for the society (Barnard, 1995). In order to reach a fair distribution Goudzwaard and de Lange distinguish between three types of economic needs

1) *material luxury needs that are either harmful or frivolous;*

2) *needs that are significant but not essential to the preservation of life;*

3) *basic subsistence needs.*

(Graafland, 2007:386)

If due to allocating of the free market scarce resources are used for the satisfaction of luxury wants (or needs) the West should give priority to the basic needs of the South so that they can reach the subsistence level. If we apply this on meat consumption this lead to the conclusion that consumers in the West should diminish their meat consumption in order to make it possible for the malnourished to fulfil their needs and hence get the subsistence level. In addition, government policy should encourage this behaviour with, for example, a tax incentive (Goudzwaard & de Lange, 1995).

e. Summary of theories

Three ethical theories give individuals the obligation to abstain or at least diminish their meat consumption and/or shift to types of meat with a lower conversion ratio. According to those theories the government should intervene if consumers do not solve the externality by themselves. Only Nozick's Libertarianism does not imply that individuals have a moral obligation to take care of the malnourished as long as the three principles of justice are respected. The government also has no right to tax meat consumption because this would infringe the free choice of people.

Theory	Individual	Government
Utilitarianism	abstain / diminish	tax
Nozick's Liberalism	no obligation	do not intervene
Positive right ethics (Shue)	abstain / diminish	tax
The ethics of care (Goudzwaard and de Lange)	abstain / diminish	tax

Table 7: Overview of theories and their conclusions.

8. Conclusion

Undernourishment is still a major problem in the world while the world produces enough food to feed almost twice the world population. The problem therefore is not a matter of production but of distribution. In a free market, like the cereal market, the distribution is determined by the market forces of supply and demand. Meat production requires huge amount of cereals and a huge part of the cereal production is used to feed livestock. Consumers in the developed world have high purchasing powers and are capable to buy a

huge part of the cereal production to produce meat in order to satisfy their wants, while the malnourished are incapable to get the subsistence level. The market does not distinguish between the want for meat and the need to get the subsistence level. Demand is determined by the purchasing power of consumers. The problem is that the needs of the malnourished poor are not registered in the market, hence considered inferior to the demand of the rich. Sen's entitlement approach gives a framework to analyze how a price shift can pull people into malnourishment A drop of the autonomous demand from the rich world is examined with a simple model. Does a drop in meat consumption lead to less malnourishment? A 50% drop in meat consumption of the developed world will end malnourishment for 258 million people and will lighten it for another 500 million. Also with other values for the demand and supply elasticities the effects on malnourishment are still largely positive. However, the model makes a couple of assumptions that do not hold in reality. That possibly changes the figures and therefore the conclusion drawn on this model.

Is it acceptable that the *invisible hand* causes malnourishment or is it not? Four ethical theories are addressed with this question. Nozick's liberalism argues that individuals do not have the duty to interfere and that the government has not even the right to interfere. Utilitarianism, the positive right ethics and the care ethics disagree with Nozick and demand from individual consumers and the government to take action against malnourishment. Which ethical theory is right is a question which cannot be answer scientifically and stays just an arbitrary opinion.

9. Recommendations

Further research should be done to figure out more reliable data on the price elasticities of demand and supply. Moreover, the model should be improved in such a way that it better mirrors the situation in the real world. If individuals can make a balanced decision about their meat consumption and the government takes measures against meat consumption, this will end or at least diminish malnourishment.

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Appendix A

Table II.2 Some estimates of aggregate agricultural responsiveness to price changes

Estimation method/model and author/source	Country or region	Data period	Estimated supply elasticities	
Cross-country				
Peterson [1979]	53 countries	1962-70	1.27-1.66	
Binswanger, et al. [1987]	58 countries	1969-78	-0.30	
Cross-farm				
Yotopoulos and Lau [1974]	India	1955-62	-0.15	
Barnum and Squire [1979]	N.W. Malaysia	1972-73	-0.02	
Time-series			**Short run**	**Long run**
Binswanger, et al. [1987]	58 countries	1969-78	0.06	-.-
Reca [1980]	Argentina	1950-74	0.2-0.4	0.4-0.8
Krishna [1982]	India	1952-75	0.18	-.-
Chhibber [1989]	India	1954-78	0.2-0.3	0.3-0.4
Other[1]	India	various	0.1-0.2	0.2-0.3
Bond [1983]	Burkina Faso	1964-80	0.22	0.24
	Ghana	1963-81	0.20	0.34
	Kenya	1966-80	0.10	0.16
	Ivory Coast	1969-78	0.13	0.13
	Liberia	1966-80	0.10	0.11
	Madagascar	1968-81	0.10	0.14
	Senegal	1970-79	0.54	0.54
	Tanzania	1972-81	0.15	0.15
	Uganda	1968-78	0.05	0.07
	9 African countries	1963-81	0.18	0.21
Intersectoral model				
Cavalla and Mundlak [1982]	Argentina	1940-72	-.-	0.90
Mundlak, et al. [1989]	Argentina	1913-84	0.19	0.99

1) Includes the study of Herdt (1970), Bapna (1981), Bapna, Binswanger and Quizon (1984), and Binswanger, Khandker and Rosenzweig (1989). These studies are discussed in Schäfer [1987] and Binswanger [1990].

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Appendix B

Millions of people	Food deficit of the undernourished (kcal/person/day)	Present consumption	Minimum energy requirement (kcal/person/day)	new level	out of malnourishment in millions
3,8	410	1380	1790	1604,708	
5,4	320	1410	1730	1639,593	
2,8	330	1430	1760	1662,849	
1	390	1430	1820	1662,849	
29	380	1440	1820	1674,478	
50,4	340	1450	1790	1686,106	
3,9	350	1450	1800	1686,106	
5,6	290	1470	1760	1709,363	
4,6	340	1470	1810	1709,363	
9,5	420	1470	1890	1709,363	
4,5	460	1470	1930	1709,363	
4,1	310	1480	1790	1720,991	
31,4	270	1490	1760	1732,619	
5,7	310	1490	1800	1732,619	
3,4	330	1490	1820	1732,619	
2,2	250	1500	1750	1744,248	
5,4	280	1500	1780	1744,248	
17,2	300	1500	1800	1744,248	
2,3	320	1510	1830	1755,876	
5,6	340	1510	1850	1755,876	
15,4	270	1520	1790	1767,504	
16,7	280	1520	1800	1767,504	
207,2	290	1520	1810	1767,504	
10	290	1530	1820	1779,132	
1,1	310	1530	1840	1779,132	
1,8	230	1540	1770	1790,761	1,8
5,6	260	1540	1800	1790,761	
27,2	290	1540	1830	1790,761	
7,3	340	1550	1890	1802,389	
1	260	1560	1820	1814,017	
0,9	220	1570	1790	1825,646	0,9
4,6	240	1570	1810	1825,646	4,6
5,2	260	1570	1830	1825,646	
0,2	280	1580	1860	1837,274	
0,8	200	1590	1790	1848,902	0,8
5,1	220	1590	1810	1848,902	5,1
0,6	230	1590	1820	1848,902	0,6
2,2	240	1590	1830	1848,902	2,2
4,7	260	1590	1850	1848,902	
0,3	170	1600	1770	1860,531	0,3
7,2	240	1600	1840	1860,531	7,2
2,2	190	1610	1800	1872,159	2,2
0,7	220	1610	1830	1872,159	0,7
2,3	230	1610	1840	1872,159	2,3
0,4	240	1610	1850	1872,159	0,4
13,7	260	1610	1870	1872,159	13,7
12,1	210	1620	1830	1883,787	12,1
14,9	200	1630	1830	1895,416	14,9
0,2	210	1630	1840	1895,416	0,2

1,7	190	1640	1830	1907,044	1,7
1,7	210	1640	1850	1907,044	1,7
0,6	160	1650	1810	1918,672	0,6
0,1	230	1650	1880	1918,672	0,1
16,5	250	1650	1900	1918,672	16,5
145,6	250	1670	1920	1941,929	145,6
0,1	160	1680	1840	1953,557	0,1
5	210	1680	1890	1953,557	5
0,4	140	1690	1830	1965,186	0,4
1	230	1700	1930	1976,814	1
0,8	150	1710	1860	1988,442	0,8
0,1	180	1710	1890	1988,442	0,1
2,2	190	1710	1900	1988,442	2,2
0,1	180	1720	1900	2000,071	0,1
0,3	200	1720	1920	2000,071	0,3
0,1	130	1730	1860	2011,699	0,1
0,1	160	1730	1890	2011,699	0,1
0,2	160	1750	1910	2034,955	0,2
1,8	210	1750	1960	2034,955	1,8
0,8	150	1760	1910	2046,584	0,8
7,3	130	1790	1920	2081,469	7,3
0,4	140	1800	1940	2093,097	0,4
1,5	170	1800	1970	2093,097	1,5
0,1	140	1850	1990	2151,239	0,1
757,9					**258,5**

Explanation of Appendix B

The 1st column shows the number of people with a certain minimum daily energy requirement (3rd column) and a certain energy deficit (2nd column). Data are abstracted from FAO (2000) for the period 1996-1998 and only include countries with a population over one million where sufficient data where available. Therefore the total number of undernourished people in this calculation (757.90) is lower then the number previously mentioned which was 861.6 million (FAO 2006a). The 5th column shows the new daily energy intake when the West decreases its cereal demand with 22%. The last column shows the number of people who get out of malnourishment due to the lower demand from the West.

For example the second last row informs us that 0.1 million people have a daily energy requirement of 1990 kcal and only have a daily intake of 1850 kcal, hence their daily energy gap is 140 kcal. Due to the price drop the malnourished in this group are able to buy 16% more cereals. The new daily energy intake is then 2151 kcal which is higher than the minimum daily amount. The last column shows the number of people that leaves malnourishment, in this row that is 0.1 million. In total for 258.5 million out of 757.8 million people malnourishment will end.