Futuro prices – an integrated sustainability assessment algorithm for products, including social aspects

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Abstract

The futuro project aims at labelling goods with their “true” (sustainable) prices. This is meant to be a support for individuals to assess their shopping behaviours in order to find their ways towards a sustainable lifestyle. The fictitious monetary unit "futuro" (1 f = 1 €) measures the sustainability price which should be added on top of the market price. Under consideration are the two social indicators “fair wages” and “social standards” and other criteria for greenhouse effect, land use, toxicity and material use. This paper explains the futuro algorithm by the comparing conventional diesel with agro diesel.

Keywords

sustainability quantification, sustainability price, footprint, fair trade, agroenergy

1. Motivation

Individuals get more and more concerned about the quality of goods (especially food) and services, but they have little means by which to judge the ecological and social impact of production, transport, use and disposal of goods and services. There are some established eco-labels, for example the ones described in Overath 2001 and Gupfinger/Mraz/Werner 2000, among them the Austrian “Umweltzeichen”, that distinguishes some goods as “better” than others in respect of their impact on the environment. On the other hand there are well established consumer information schemes which try to rank products and services according to specific criteria (like the VKI – "Verein für Konsumenteninformation" in Austria). Still, there remains the question whether this information is able to fully reflect the scope of sustainability (i.e. economic, social and ecological) and whether it is profound enough to show how much better a good is compared to another, to allow for price-like comparisons.
In order to overcome these shortcomings, the futuro project aims at labelling goods and services with the essential information to make this sort of comparison possible. The aim is to provide an algorithm to do this in the form of a "shadow price" (i.e. an ecologically and socially fair price = “sustainability price”), given in the fictitious monetary unit of ƒ (“futuros”).

The higher the sustainability price of a product, the less sustainable is the product. While the market price measured in € is paid by the consumers, the sustainability price given in ƒ is a fictitious extra charge, which considers sustainability and should be added on top of the market price.

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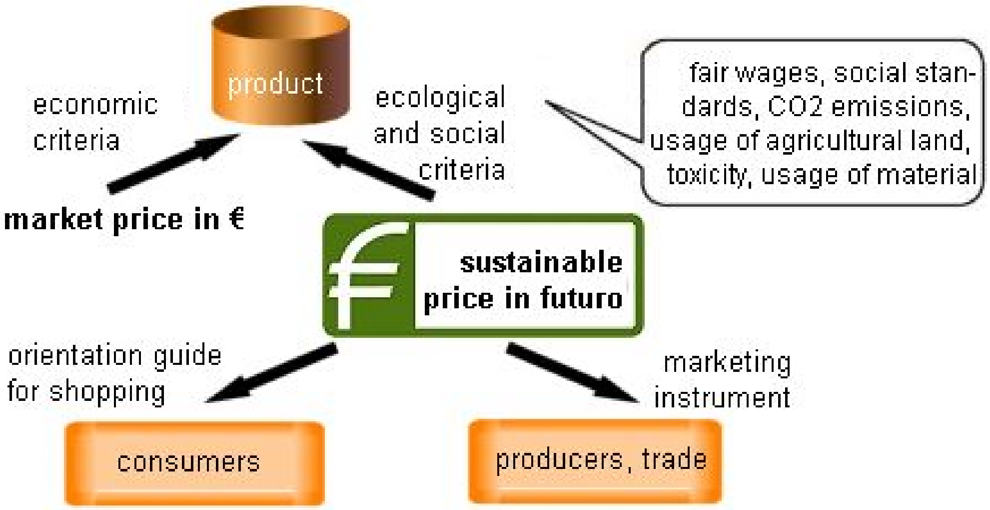

Figure 1:The meaning of the futuro price

2. The 2003 futuro methodology

2.1 The indicators

The methodology works with six environmental and socio-economic criteria for the calculation of the so-called “futuro value”: Greenhouse effect, wages, social standards, land use, toxicity and use of material/natural resources (Jakubowicz et al. 2004). The indicators were picked from the wide range of existing indicators (EC 2005) by means of expert interviews and a participatory process, in order to cover the scope of sustainability as broadly as possible. (Bußwald et al. 2002)

For each criterion, an indicator has been selected and a price factor has been determined, which allows the transformation of the indicator value into a monetary scalle.

2.2 The calculation of a product’s futuro price

In order to calculate a futuro price for a product, data for the indicators of all criteria have to be collected along the life cycle of the product. For the criterion “greenhouse effect”, the CO_2 equivalents of emissions along the production and transport chain of the product (and its pre-products) have to be collected and summed up. The sum then has to be multiplied by the greenhouse effect price factor. The result is a single-criterion futuro price.

For the other five criteria the procedure is carried out in the same way. Especially for the social criteria “wages” and “social standards” it needs some calculation to fix the unpaid wages and the different social standards. In the end all data will be multiplied by the futuro price factors to build the single-criterion prices, which again can be added up to the final futuro price of the product (see Table 1).

criterion	**data to be collected**	**transformation process by futuro price factors**	**single-criterion-prices**
wages	X_1 [€ unpaid wages]		Y_1 [futuro]
social standards	X_2 [€ unpaid social expenses]		Y_2 [futuro]
greenhouse effect	X_3 [kg CO_2 equivalent]	→	Y_3 [futuro]
land use	X_4 [m^{2}a agricultural land used]	each value multiplied by the corresponding price factors F_1,...F_6	Y_4 [futuro]
toxicity	X_5 [m^{2}a polluted land]		Y_5 [futuro]
use of material/natural resources	X_6 [kg]		Y_6 [futuro]

resulting futuro price: $Y_1+Y_2+Y_3+Y_4+Y_5+Y_6$

Table 1: Resulting futuro price (x_1, …, x_6 indicator values; y_1, …, y_6 single-criterion-prices)

With a different algorithm (Jakubowicz et al 2003) we assessed the futuro prices of apple and orange juices. This assessment was based on (1) statistical data, (2) formulas to determine consumption-related emission figures like “all CO_2 emissions which are due to consumption of products in Austria”, (3) relative weights to determine the relation of the single criteria (derived from an opinion poll in Austria), see Bußwald et al. 2002a and Bußwald et al. 2002b.
In 2008 we did a review especially of the social criteria and started a process of monetising all criteria without the relative weights which were based on the opinion poll. This new algorithm is presented in this paper.

3. "Wages" criterion

We start with “wages”. For this criterion we were already quite satisfied with the method developed back in 2003, but we put some effort into improving the structure and applicability.

3.1 “Difference of wages” and “withholding factor”

Our starting point is the “difference of wages” indicator. We want to quantify the wages withheld in other (especially poorer) countries (i.e., all non-EU-countries with lower average income than Austria) which are involved in the production chain of a product. A product can pass several steps in different countries. Standards of living or average incomes can – to a certain precision – be found on country level from statistical sources.
As we are looking for the “difference of wages”, we also need to look at the “consuming country”. In our case, we did our research for the “consuming country” Austria. It is easy to adapt the figures to other typical “consuming countries” from “the North”, e.g. from the EU-25, Australia, Canada or the US.

To start with, we looked at Brazil as a producing country (because we know we want to assess the soy bean oil originating from Brazil) and Burkina Faso, as this is a special focus country of the Austrian Development Agency.

	Estimated earned income (PPP US$) 2005 (Source: UNDP 2007)		Economically active population (2005) (Source: ILO)		Average income per economically active person [€]
	Female	Male	Female	Male	
Brazil	6,204	10,664	39,119,000	52,259,000	7,045
Burkina Faso	966	1,458	2,721,000	3,114,000	989
Austria	18,397	40,000	1,829,000	2,203,200	24,304

Table 2: incomes in Brazil, Burkina Faso and Austria

The estimated earned income per economically active person has been calculated as follows:

$$Av.income_{Country}(€) = \frac{Av.income_{female} * Ec.act.pop._{female} + Av.income_{male} * Ec.act.pop._{female}}{Ec.act.pop._{female} + Ec.act.pop._{male}} * exchange\ rate_{\$ \to €}$$

For the exchange rate (2005) we used 0.804745.

How can we use these figures for assessing the “unfairness of the wages” within one specific product?
To answer this question we use the import value of products. For instance, for soy bean oil it is easy to find out the import value of getting the oil from Brazil to the EU.

Assuming that the import value has a strong correlation to the work load of the pre-product (here, the soy bean oil), we arrive at the following formula:

Wages futuro price of a product = import value · “wages withholding factor”

The “wages withholding factor” can be pre-calculated for each importing country, here we show it for Brazil and Burkina Faso:

$$f_{Brazil}^{wages} = \frac{Av.income_{Brazil}}{Av.income_{Austria}} - 1 = \frac{7,045}{24,304} - 1 = 3.45 - 1 = 2.45$$

The withholding factor expresses, that for each € paid for wages in Brasilia 3.45 € should have been paid (“withheld wages”), resulting in an “unfair saving” of 2.45 € per each € paid (“withholding factor”).

For Burkina Faso the factor is $f_{BurkinaFaso}^{wages} = \frac{989}{24,304} - 1 = 23.58$

In general the factor can be written as:

$$f_{Producing\ Country \rightarrow Consuming\ Country}^{wages} = \frac{Av.income_{Producing\ Country}}{Av.income_{Consuming\ Country}} - 1$$

As the incomes are given in PPP US$, purchasing power is taken into account and does not bias our result.

3.2 The national level

On the national level our approach can be used to calculate how much the consumers of one specific consuming country of the North save per year by means of “withheld” wages for the products consumed from the South.

To do this we look at trade statistics, i.e. the values traded.
We compared two sub-methods:

1. using import values from direct imports to a European consuming country, here Austria
2. using import values into the EU and assigning Austria a share according to the share of GDP in the EU (2.17%)

We found out that the second value is by far more realistic, as it “corrects” internal EU trade, so if some goods are imported to France and used to manufacture finished products exported to Austria, method 1 would not account for these products. Method 2 does.

For every country of the South (i.e., all non-EU-countries with lower average income than Austria) we collected the following data:

	total exports to the world (€)	exports to EU-25 (€)	exports to Austria (€)	exports to Austria (as 2.17% of EU-export) (€)	Percentage of exports to Austria (as part of EU) in relation to total exports
Brazil	95,385,369,120	23,286,006,194	300,364,090	506,208,840	0.53%
Burkina Faso	316,640,469	29,962,420	1,287,771	651,346	0.21%

Table 3:exports from Brazil and Burkina Faso to the world, the EU and Austria
Source: UNCOMTRAD 2005

Based on the export figure we can finally calculate the amount of money Austrian consumers “owe” to the producers/working people in Burkina Faso as 651,346 · 23.58 = 15,360,162 €. We note that each Austrian consumer / citizen would have to pay approx. 15,360,162 / 8,200,000 = 1.87 €/year to Burkina Faso to compensate for these unpaid wages. We also compared these values with the donations from Austria to Burkina Faso, which only amount to 0.25 €/Austrian and year (including money from migrants going back to Burkina Faso!), which is less than 1/6 of the withheld wages!

	Wages withholding factor (€)	Wages withheld for all goods consumed in Austria	wages withheld per Austrian
Brazil	2.45	1,240,055,470	151.23
Burkina Faso	23.58	15,360,162	1.87

Table 4:Withheld wages for Brazil and Burkina Faso, compared to Austria

We did the same calculation for Brazil and all countries of the South and found an amazing sum of **46,968,942,503 €** Austrian consumers owe to the people in the countries of the South *per year*, which is around 5,728 € per Austrian and year (Bußwald et al 2009).

3.3 Main assumptions and questions

Several questions remain unsolved when using the algorithm described above.
The most accurate method to determine the unfairness of wages would be to weight the working hours by the “cost rate withheld” (= cost rate in Austria minus cost rate in the country to be considered).
There are two obstacles to carry out the calculation:

1. On the product level it is very difficult to find out how many working hours are included in a product (and at what cost rates)
2. On the national level available data on average income does not provide a relation to the performed working hours. It is also not clear whether the figures include self-employed earnings. Data on working hours performed per country and year are also only available for few countries.

Moreover at the moment we only operate with average incomes on national level, it would be much more precise if we had data about average incomes of industry sectors, ideally in combination with the national level. Of course we could even go into more detail, collecting the real data / real wages people are earning working on a specific product.
Besides, the value of exports from one country into another cannot fully be attributed to work fees, this amount also includes market factors (like the scarcity of a product [e.g. gold, diamonds] or shareholder profits). Transnational corporations can also use exports from one branch of a company to another to “save taxes” by valuing these exports at “fantasy rates”.
These and some other effects will be studied in future calculations.

4. "Social standards" criterion

Originally we took the Gender-related Development Index GDI (from Human development report 2007/2008) as a main influencing factor on the social futuros. We decided for the GDI, as the GDI with its gender aspects is more suitable than the Human Development Index HDI.
Now our recent research showed that there is a good correlation between GDI and social expenditures and in order to get monetary values we thus now based our algorithm on the social expenditures.

4.1 Indicator “difference in social expenditures” and its “withholding factor”

We are again looking for a “social standards withholding factor” that can be applied similar to the “wages withholding factor” as follow:

Social standards futuro price of a product =
import value · “social standards withholding factor”

We first collect data about the social expenditures of all countries, especially Austria and the countries of the South:

	PPP GDP/capita (1000 €)	Public expenditure on health1 (% of GDP) in 2004	Public expenditure on education1 (% of GDP) 2002–2005	Total public expenditure (% of GDP)	Total public expenditure / capita (€)	Difference to Austria / capita (€)
Brazil	8,402.64	4.80	4.40	9.20	622.06	2,984.89
Burkina Faso	1,215.83	3.30	4.70	8.00	97.27	3,509.68
Austria	33,836.46	7.80	5.50	13.30	3,606.95	

Table 5: Social expenditure for Brazil, Burkina Faso and Austria
Source: World Bank 2005, UNDP 2007

For the calculation of the withholding factors, we assume that the difference in social standards per capita would have to be paid for all the people of the specific country.
So, for Brazil we get 2,984.89 · 186,400,000 = 556,384 Mio. € withheld social expenditures.
As Austria takes 0.53% of the exports of Brazil, Austria has to “pay” this share of the withheld social expenditures, which amounts to 2,949 Mio. € (see Table 6).
In the same way, we calculate that Austria’s ethical responsibility for the social system of Burkina Faso is equivalent to the export percentage of Burkina Faso coming to Austria = 0.21%. Burkina Faso spends 97.27 · 13,200,000 € a year and would have to spend 3,509 · 13,200,000 = 46,319 Mio. € more, the “social expenditure difference”; the Austrian responsibility share of this amount is 0.21% giving 97.27 Mio €.

	exports to Austria (as 2.17% of EU-export) (€)	Percentage of exports to Austria (as part of EU) in relation to total exports	Difference to Austria / capita (€)	Total social difference (Mio. €)	Austrian share of social difference (€)	social withholding factor (€/€ import value)
Brazil	506,208,840	0.53%	2,984.89	556,384	2,948,832,529	5.83
Burkina Faso	651,346	0.21%	3,509.68	46,319	97,269,480	149.34

Table 6: the social withholding factor for Brazil and Burkina Faso

This delivers the social withholding factor of 9,529,865 / 651,346 = 149.34 € / imported € from Burkina Faso, 5.83 € / € imported from Brazil.

4.2 The national level

Thus, each Austrian “withholds social security” of 97,269,480 / 8,200,000 = 11.86 € per year from the citizens of Burkina Faso (by importing products from this country that are cheap not only because of low wages but also because of an inferior health and education system).

From the above figures, we can see that every Austrian citizen saves a greater amount by the withheld social standards compared to the withheld wages.

	social expenditures withheld per Austrian	wages withheld per Austrian
Brazil	359.61	151.23
Burkina Faso	11.86	1.87

Table 7: the social withholding factor for Brazil and Burkina Faso

4.3 Main assumptions and questions

The main question is here, if there is an intersection between wages and social standards which would lead to double counting (and thus overestimating of the withholding sums we “receive” from the countries of the south).

- How much have the income values to be reduced, as they probably include some part of the social expenditures.

- And the other way round: What portion of the social expenditures of the countries is financed by taxes on income?

Another question is whether it is appropriate to distribute the total social difference to the exports. This approach would not be possible for countries with no exports at all. One could argue that some part of development aid should not be paid by the buyer of exports but by the taxpayer in rich countries and hence not be included in the futuro price.
On the other hand, when exports are going from a poor country to an even poorer country then the buyer in the poorer country should not have to pay for "withheld social expenditures". This would increase the contribution of the buyers in rich countries.
Future research will show which refinements are most appropriate.

5. "CO_2 emissions" criterion

The cost of damages caused by climate change and the costs of mitigating measures cannot be calculated precisely. Most studies compute values between 30 and 100 €/t CO_2 equivalent. A WWF study (Allianz Group and WWF 2005) came to 80–140 €/t. We decided to use 100 €/t for the CO_2 part of the futuro price. This is far more than current CO_2 certificate prices and current CO_2 avoidance costs by using the cheapest measures to reduce emissions (some of the measures, like better building insulation, are even profitable). However, we assume that all cheap measures will be used sooner or later anyway, so every ton of CO_2, which will be emitted additionally today, will have to be reduced by expensive measures in the future. Also we assume, quite pessimistically, that the "business as usual" will continue for a long time and hence, the damage costs of climate change will be relatively high.
The 100 €/t can be interpreted as costs, which are caused by the buyer of a good but are not paid by them (due to market failure). I.e., these are external costs, which should be added on top of the market price. The costs will arise at some time in the future and will be born by somebody else. We do not use any discounting to convert this future costs into today's values. We use today's prices or prices expected in the future with the foreseeable evolution of available technologies. Of course, in the future there might be completely new technologies like fusion reactors available but this cannot be taken for granted and will not be assumed by us.

5.1 Main assumptions and questions

It remains unclear how the deaths caused by climate change have been valued in the above studies and how they should be valued.

6. "Land use" criterion

A WWF study (WWF 2009) computed the economic value of 1 hectare of Amazonas rain forest at 380 €/a. This value usually is ignored in the case of deforestation or other forms of land use. We consider this value as the external cost of using 1 ha of fertile agricultural land for 1 year. Since world trade connects economies worldwide, we apply this value for all countries of the world. However, we distinguish between eleven agricultural regions that have different fertilities. Fertility f_A is determined by the maximum calories which can be harvested on an area in the agricultural region A. The futuro price of land use in region A then equals 380 €/ha/a · $f_A/f_{\text{rainforest}}$.
This means that, for example, land use by a solar power plant in the desert equals 0 futuro because the land could not have been used for agriculture. Using grass from a hill farm for biogas production causes less land-use-futuro/ha/a than using corn planted on fertile fields but its land-use-futuro/ha/a amount is greater than 0 – because the grass could also be fed to cows; if used for bio energy production instead, some cows must be fed with food from somewhere else.

6.1 Main assumptions and questions

We assume that any additional land use eventually might cause increased land use in species-rich forests like at the Amazonas. This can be seen, for example, in the case of agro petrol production, which causes more oil from palm oil plantations to be imported by the food industry in the rich countries. Agricultural areas previously used for human nutrition are being dedicated to bioenergy, requiring the creation of new agricultural areas in former rain forests in other places of the earth.

Another effect, not yet considered for futuro, is the increase in prices for agricultural products caused by smaller amounts harvested due to land use for other purposes. This might eventually cause more people to starve.

Not only land use but also subsidies for bioenergy production cause rising prices. When a farmer is paid well for growing bioenergy plants then growing food must be paid well too – otherwise, the farmer will not cultivate food any longer (if bioenergy subsidies are unlimited). This price effect is independent of the hectares actually used for bioenergy production. The sole possibility of getting higher prices causes food prices to rise. This effect cannot be attributed to "land use". It would require an independent new criterion, which is currently not present in the futuro methodology.

What is still open to discussion is what value should be assigned to pristine nature and species diversity. The currently used 380 €/ha/a is the economic value only. We believe that the "real" value is significantly higher.

7. "Toxicity" criterion

Pollution of land causes long-lasting adverse effects to people and the environment. Removing poison from land can be very expensive and sometimes impossible. For now, we consider in our futuro assessment only the external costs of organic agriculture and conventional agriculture respectively (excluding CO_2 costs since they are considered separately).

External costs of land use are caused by soil degradation, fresh water pollution (requiring water treatment), contaminated or destroyed biotopes (requiring more money spent on nature reserves), impaired health of consumers due to toxic residues etc. An English study has estimated the external costs of conventional farming at 110–370 €/ha/a (Kratochvil 2002).

Studies comprehensively comparing conventional with organic agriculture are rare. CO_2 from organic agriculture is estimated by some studies (Haas & Köpke 1994 and Röver et al. 2000, quoted by Kratochvil 2005) to be around 1/3 of the value of conventional agriculture (plant production only, not animal husbandry). We assume that total external costs of organic agriculture are also 1/3 of the external costs of conventional agriculture.

Since most studies do not seem to include and quantify all forms of external costs, we feel compelled to use higher values than estimated by them. On the other hand, CO_2 costs have to be removed since we consider CO_2 costs separately. Therefore, we decided to use 300 €/ha/a for agricultural land use (from the range 110–370 €/ha/a given above) and 100 €/ha/a for organic land use. These values have to be multiplied by the fertility factor $f_A/f_{\text{rainforest}}$ introduced in the previous section.

When more comprehensive studies are available we will update these figures.

8. "Material use" criterion

The best ores are used first since their extraction is cheapest. However, the more they are exploited, the more their extraction costs will rise in the future. We consider this as some kind of external costs caused by today's buyer.

Using fossil energy is obviously not sustainable because it will not be renewed in time scales relevant for humans. Consuming an amount today means that at some time in the future somebody must pay the higher price for the same amount of renewable energy. Of course, we do not know what technologies will be available by then and at what prices. We make the

pessimistic assumption that only today's technologies will be available and that they will not be cheaper than today. This means that fossil diesel should cost the same as agro diesel.
However, comparing today's *market prices* appears questionable since they are very volatile and it does not mean that the future consumer forced to use renewable fuel has to pay less if today's oil price is high. This would only be true if the extra profit earned from high oil prices were to be saved for the future until fossil reserves were exhausted or if it were invested in renewable energies so that they could fully substitute fossil energy at prices not higher than today.
Hence we use production costs instead. We assume production costs of 20 US$/barrel for fossil oil and 100 US$/barrel for the renewable fuel energy equivalent. While some processes for agro fuel generation are currently cheaper than 100 US$/barrel, one has to consider that the production costs will rise when there is no cheap fossil energy available anymore. Actually, it could turn out that 100 US$/barrel is a quite optimistic estimate, which will have to be corrected when better studies are available. We also neglect the fact that it will not be possible to produce agro fuel to the amount which is consumed today in the form of fossil fuel. This means that prices will rise even higher until the demand decreases so that it can be met. However, we also disregard the potential competitiveness of other technologies such as solar energy. This will increase supply, dampening prices.
So, taking into account the non-sustainability of consuming fossil energy, we add a "material"-futuro of 100 – 20 = 80 US$ for each barrel of oil used in the product under consideration. Optionally, the futuro price of 1 barrel agro fuel could be added. This is not done in this paper. More research is needed as to what set of circumstances can be expected in the future and what kind of extra futuro charge will result.

9. The futuro price of conventional diesel

We assess 1 kWh of conventional diesel. This is equivalent to 0.10 l of conventional diesel (or 0.11 l agro diesel). An ecological assessment of the car is not included, nor is traffic infrastructure such as fuel stations.
According to Fachverband der Mineralölindustrie Österreich 2007, Austria is importing crude oil from Kazakhstan, Libya and several other countries. We calculated wages and social withholding factors as we did in previous chapters, and summed them up proportionally, assuming that every amount of conventional diesel consumed in Austria accounts for the same relative shares from all supplying countries as the total amount imported by Austria.
The total CO_2 emissions (including extraction and production of the fuel) have been estimated by Austrian Umweltbundesamt (2009a) at 137 g/km. Assuming that a car consumes 7 l/100 km, it emits 196 g/kWh.
Land use by fossil fuel extraction and refining has been neglected. Hence, there are also no “toxicity”-futuros. Oil accidents have not been considered either. Also residues from drilling (boring sludge) can be problematic (GEMIS, Info: Erdgas) but have not been included in our assessment.
For “material”-futuro, the factor 80 futuro/barrel applies. We assumed that 1 kWh crude oil is required to produce 1 kWh diesel. This is not true but you can create 1 kWh of diesel, petrol and other fuels out of 1 kWh crude oil. Since there is nothing wasted, we think our assumption is appropriate.

	value	· factor =	futuro
Wages	0.1174 €	1 futuro/€	0.1174
social standards	0.0465 €	1 futuro/€	0.0465
CO_2	0.1957 kg	0.1 futuro/kg	0.0196
land use	0 m²a	0.038 futuro/m²a	0
toxicity (conventional farming)	0 m²a	0.03 futuro/m²a	0
material use (crude oil)	0.17 kg	0.23 futuro/kg	0.0387

Total			**0.2222**

Table 8: futuro price of conventional diesel

10. The futuro price of agro diesel from rape-seed

Now we assess diesel made from rape-seed. The rape-seed is assumed to come from domestic farmers. So, no futuros for wages or social standard arise.
The CO_2 emissions have been estimated by Austrian Umweltbundesamt (2009a) at 118 g/km. Assuming that a car consumes 7 l/100 km, it emits 169 g/kWh. This amount does not take into account the replacement effects. Neither do we allow for animal feed from rape-seed residues, replacing, e.g., soy bean imports; nor for agro diesel production from rape-seed, causing higher prices for rape oil and therefore imports of cheaper palm oil by the food industry.
About 1480 l of oil can be earned per hectare and year (Fachagentur Nachwachsende Rohstoffe e.V. 2008). This determines the “land use”-futuros. Any energy used in farming and conversion to agro diesel is conventional energy (otherwise, the yield would be lower than 1480 l/ha/a). Fertility of land used for rape cultivation must be high, so we apply a fertility factor of 1.
As far as we know, the amount of rape cultivated organically is negligible. So, the “toxicity” futuro factor of 300 futuro/ha/a applies.
Although fossil fuel is used for the production of agro diesel we did not take it into account because it is not a necessary input.

	value	· factor =	futuro
Wages	0 €	1 futuro/€	0
social standards	0 €	1 futuro/€	0
CO_2	0.1686 kg	0.1 futuro/kg	0.0169
land use	0.745 m²a	0.038 futuro/m²a	0.0283
toxicity (conventional farming)	0.745 m²a	0.03 futuro/m²a	0.0224
material use (crude oil)	0 kg	0.23 futuro/kg	0
Total			**0.0676**

Table 9: futuro price of agro diesel from rape-seed

11. The futuro price of agro diesel from soy beans

The process of making agro diesel from soy beans is similar to the process of rape-seed diesel production. The main differences are the origin and the yields per hectare. The biggest soy exporter is Brazil. So we calculated the futuro price for Brazil soy bean. The exact origin of soy bean agro diesel consumed in Austria is unknown (and probably irrelevant owing to globalisation).
For wages and social standard we have the futuro factors already calculated in previous chapters. As import value we used the Soybean Oil future price from the Chicago Board of Trade.
CO_2 emissions are the same as for agro diesel from rape-seed. Additionally we assumed 12,000 km transport by ship with CO_2 emissions of 0.0095 kg/tkm.
Soy bean oil yield amounts to 502 l/ha/a (Union zur Förderung von Oel- und Proteinpflanzen, UFOP, according to Greenpeace 2008). This is only about 1/3 of the yield in the case of rape-seed. Hence, land use is higher. Fertility of the agricultural region is the same.

	value	· factor =	futuro
wages	0.2038 €	1 futuro/€	0.2038
social standards	0.4853 €	1 futuro/€	0.4853
CO_2	0.1796 kg	0.1 futuro/kg	0.0180
land use	2.289 m²a	0.038 futuro/m²a	0.0870

toxicity (conventional farming)	2.289 m²a	0.03 futuro/m²a	0.0687
material use (crude oil)	0 kg	0.23 futuro/kg	0
total			**0.8628**

Table 10: futuro price of agro diesel from soy beans

The table clearly shows that the biggest amounts are accounted for by wages and social standards withholding.

12. Conclusions

We showed an approach to computing the sustainability prices of products, which we believe is a valuable contribution to the field of social LCA (Grießhammer et al 2006). This approach shows that agro diesel from rape-seed is more sustainable than conventional diesel but agro diesel from soy beans is less. Sustainability is quantified in monetary terms. Social aspects as well as environmental aspects are considered. We believe that the result – a shadow price for each product – is easy to understand and helpful. However, further research is necessary to extend, refine and verify the methodology.

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