The "Real" Price of Palm Oil

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Abstract

The expansion of palm oil production in South East Asia resulting from an increased concern for future energy supply has raised much controversy. Much current research focuses on the impact of palm oil production on levels of carbon emissions, but little is known about the impact of palm oil production on food scarcity. This research conducts a cost-benefit analysis in order to price the "real" cost of palm oil that has been derived from a plantation that replaces food production. This paper concludes that palm oil production threatens global food security instead of solving the problem of future world energy supply.

Key words: Cost-benefit analysis, biofuels, global food security, future energy supply, environmental economics, palm oil industry

Introduction

Palm oil and its fast growing expansion in Indonesia, especially into forested areas, have caused controversy. On the one hand, palm oil production is a driver of deforestation and forest fires, resulting in biodiversity loss and increased food prices and scarcity. On the other hand, palm oil is an alternative source to fossil fuels, and a major driver of economic growth and development (Sheil et al., 2009). The question whether palm oil's benefits for world energy supply exceed its environmental costs or vice versa is important as the world markets for edible oils are expected to double by 2020 (Carter et al., 2007; Colchester et al., 2007). As long as there is willingness to plant plantations in environmentally sensitive areas the industry will continue to grow at the expense of tropical rain forests or cropland vital for the world's food production (Carter et al., 2007). It is crucial to get a clear picture of the situation and issues surrounding palm oil production, in order to evaluate the necessity and appropriateness of governmental interventions at the domestic and international levels before negative environmental impacts are irreversible. As world prices often do not reflect the real picture of all the costs and benefits resulting from an economic action a cost-benefit analysis can reveal the "real" price of a good. This research conducts a cost-benefit analysis in order to find out, whether the price of crude palm oil reflects all of the costs and benefits resulting from replacing food production with palm oil production. Therefore, this paper first looks at the potential and risk of crude palm oil production. Second, this study wants to know whether the "real" price of crude palm oil is competitive in the world market, as this is vital when making a decision on whether to support future palm oil production at a global level.

Literature Review

Benefits of palm oil

In 2006 palm oil and biofuel production were expected to contribute to energy security, mitigate global climate change and accelerate growth in the agricultural sector and developing countries (FAO, 2008). Several governments based their decision on promoting biofuel production on these promising expectations. Most authors are agreed that palm oil has the potential to replace fossil fuels and reduce greenhouse gas emissions. Crude Palm Oil (CPO) is cheaper than other biofuels and can reduce emissions by 41% as compared with fossil fuels. Palm oil plantations may also be a more efficient carbon sink than first-degree rainforests (Tan et al, 2009). As a result of its potential use as a biofuel, palm oil production is one of the fastest growing sub-sectors of the Indonesian economy (Casson, 2003). The palm oil industry has the ability to earn foreign currency, provide jobs all year round and therefore accelerate GDP growth (Casson et al., 2008; Potter, 2001). 6.2 million hectares of palm oil create enough jobs to help approximately 6 million people to get out of poverty (Goenadi, 2008).

Costs of palm oil

On the other hand the potential costs of CPO as a biofuel are emphasised by a range of environmentalists, NGOs and environmental economists. CPO production threatens traditional livelihood, deforestation and biodiversity, and increases the risk of fires and food scarcity (Sheil et al., 2009; Danielsen et al., 2009; Casson, 2003; Padmanaba & Sheil, 2007; Potter, 2001). While these environmental costs of biofuel production are well-rehearsed, the potential impact on food security is of more recent concern and has been less explored. Copenhagen Economics (2011) highlights the growing concern that the production of biofuels will add to the scarcity of arable land and threaten food security, which is defined as "the access for all people at all times to enough food for an active, healthy life" (FAO, 1996: 1). The increasing demand for palm oil acts as an incentive for farmers to expand the area of palm oil plantations (Casson et al., 2008). If the effect of change in land-use for biofuel production is too large, foreign production might not be able to cover the entire amount of increased demand for food (Copenhagen Economics, 2011; FAO, 2008; Conceicao & Mendoza, 2009; Cassman & Liska, 2007; von Braun, 2007).

Authors are agreed that biofuels threaten food security, especially for the poorest of the world's population, who spend up to half of their incomes on food. Higher food prices force the poorest of the world population to purchase cheaper food, which lack important nutritional values (von Braun, 2007). Recent price increases in cereals and vegetable oils have been attributed to biofuel production. Biofuel production increases land values and land competition (FAO, 2012). However, the effect of this factor remains uncertain. The problem of food insecurity, poverty and hunger is a complex one. One major problem of providing food security is not necessarily a lack of food production capacity but the global production allocation. The majority of global agricultural land meets the high value-crop demand of the developed countries rather than producing according to the needs of the poor (FAO, 2008).

Hence, while CPO production has positive effects on alleviating global energy shortages, the literature indicates that there are many negative effects. There is a developing debate about the negative and positive externalities of replacing food production with palm oil plantations, which this research addresses.

The “real” price of palm oil

Palm biodiesel will only be economically viable if prices for CPO remain at a level where palm biodiesel is more competitive than fossil- and other bio-fuels while being ecologically efficient. Palm oil is more expensive than crude oil. However, among the biofuels palm oil is the cheapest vegetable oil. At the same time palm oil production has higher environmental costs compared to 17 out of 26 biofuels and all fossil fuels revealed by a study by Zah et al., (2007). This seems to be contradictory. How can the price of palm oil be competitive, if the production has such high environmental costs? The question arises whether the price of crude palm oil reflects all costs of externalities, and if it does not is the “real” price of palm oil still economically and ecologically viable? The challenges of finding the “real” price of a good are to “price the priceless” environmental externalities (Heinzerling & Ackermann, 2002).

A cost-benefit analysis (CBA) is a widely used environmental policy tool to indicate whether and how the government should intervene in the market. However, a CBA is a controversial tool. Those in favour argue that the CBA increases government and market efficiency and creates a more objective and transparent decision-making process (Hanley et al., 2001). Heinzerling and Ackermann (2002) argue that the CBA as a policy tool is highly flawed, because it has to attach monetary values to anything from loss of habitat to loss of human life. On the other hand if a price is not attached to the environment in modern market economies it is included as zero in the global economy, which is an incentive to exploit or replace natural ecosystems bearing tremendous risks (Doornbosch & Steenblik, 2007; Harris, 2006).

One key element of the process of conducting a CBA is how to evaluate the costs and benefits that are often felt far into the future. According to the Hotelling rule the discount rate indicates, whether present consumption is favoured over future consumption (Hanley et al., 2001). If the discount rate (dr) is larger than zero (dr > 0) present benefits are weighted more heavily than future benefits. Consequently, the higher the discount rate the higher the incentive to exploit the environment and its natural resources (Stern, 2009). Environmental economists argue for different discount rates. In order to avoid the difficult task of picking one this research discounts the costs and benefits at three different discount rates so that we can base this research on a range of low, medium and high discount rates.

This paper focuses on the “real” price of palm oil, the price that reflects a real picture of the costs and benefits of palm oil production that replaces agricultural land. Consequently this research conducts a cost-benefit analysis on the costs and benefits arising from an expanding palm oil production through replacing already existing agricultural land in Indonesia to analyse the hypothesis that the price of crude palm oil does not reflect the negative externality of threatening global food security.

Research Methodology

For this cost benefit analysis we are looking at the externalities resulting from this production affecting the world's population. Table 1 shows the global costs and benefits of the change of land use from food production to palm oil production. Note that all costs and benefits used in this study are related to one hectare of land.

Table 1

Social Cost and Benefit Analysis of Palm Oil	
Costs	**Benefits**
i. Increasing food scarcity and risking starvation	i. Avoided deforestation
ii. Carbon stock value emitted by changing use of land	ii. Reduction of CO_2
iii. Agricultural land replacement	iii. Agricultural land replacement
iv. Cost of land	iv. Crude palm oil is the cheapest alternative to fossil fuel
v. OPEC oil is cheaper than palm oil	
vi. Subsidies	

Pricing the costs

i. Increasing food scarcity and risking starvation.US$ 6.3 million, which is what one is willing to pay to avoid the risk of the occurrence of an event that would lead to a person's death on average, is a commonly used estimate of the cost of putting one human life at risk (Heinzerling & Ackerman, 2002). According to FAO (1993) 0.07 hectares are the absolute minimum to support one person's life and this estimate is the appropriate value to use when referring to world supply (FAO, 1993). Therefore one-hectare arable land can provide for approximately 14 people.

Price of risk of starvation per hectare of lost agricultural land:

$$6{,}300{,}000 \times 14 = \text{US\$}88{,}200{,}000$$

ii. Carbon stock value emitted by changing use of land.

Carbon stock value of temperate cropland is between 111-515t CO2 per hectare. We take the middle value (313t) and multiply by the price of one t CO2 given as US$8.31 (EEX, 2012).

Price of the carbon stock value emitted:

313 x 8.31 = US$2601.03

iii. Agricultural land replacement. As the land required, according to its productivity and its carbon stock differs, this variable is left out at this stage.

Table 2: Carbon stock value of different types of land

Area Type	Carbon stock value t CO_2 / hectare	Price range (CO_2 2013)
Tropical forest/ rain forest, Brazil/ South East Asia	359 – 2572	$2983.29 - $21373.32
Temperate forest, Europe	172 – 1077	$1429.32 - $8949.87
Boreal forest, Canada	71 – 1085	$590.01 - $9016.35
Cerrado grassland, Brazil	139 – 311	$1155.09 - $2584.41
Temperate grassland	139 – 718	$1155.09 - $5966.58
Temperate cropland	111 – 515	$922.41 - $4279.65

Source: Derived by Hannah Detmering from Copenhagen Economics (2011)

iv. Cost of land: There was a lack of data for the price of land. Therefore, this research uses a proxy value found via online search (http://www.alibaba.com/showroom/palm-oil-plantation-in-indonesia.html). The price of land per hectare:

US$ 50,286

v. OPEC oil is cheaper than palm oil: We subtract the monthly crude palm oil prices per tonne from the monthly oil prices per tonne over 7 years.

The price of purchasing crude palm oil instead of crude oil:

(18,409.3501 x 5) / 7 = US$13,149.53579

vi. Subsidies: One tonne biofuels receives a subsidy of US$500 (Doornbosch & Steenblik, 2007). This is used as a proxy for the global consumer cost.

The cost of subsidies per hectare per year: US$ 2,500

Table 3

Summary of pricing the costs	
i. Increasing food scarcity and hunger	$88.2 million
ii. Carbon stock value emitted by changing use of land	$2603.01
iii. Agricultural land replacement	No data
iv. Cost of land	$50,286
v. OPEC oil is cheaper than palm oil	$13,149.53579
vi. Subsidies	$2,500
Total	$88,268,538.55

Pricing the benefits

i. Avoided deforestation: The estimates made by Copenhagen Economics (2011) shown in table 2 are used to price this social benefit. The upper limit of the carbon stock value of forests in South East Asia is used to consider the missing data on the cost of loss of biodiversity.

The price of avoided deforestation per hectare:

US$ 21,373.32

ii. Reduction of CO_2: Tan et al. (2007) reveals that palm oil plantations convert 64.5 t/ha of carbon dioxide. CO_2 costs US$ 8.31. The price of CO2 reduction:

64.5 x 8.31 = US$ 535,995

iii. Agricultural land replacement: Agricultural land replacement eventually weakens the food scarcity again but to what extent is not predictable. Due to a lack of data this study will not look at this variable.

iv. Crude palm oil is the cheapest alternative to fossil fuel: To price this benefit this study subtracts the monthly palm oil price from the average price of soybean and rapeseed oil.

The price of this benefit amounts to US$ 11,889.64286 per hectare per year:

(16,645.5 x 5) / 7 = 11,889.64286

Table 4

Summary of pricing the benefits	
i. Avoided deforestation in terms of CO_2 release	$21,373.32
ii. Reduction of greenhouse gas emissions by new carbon sink	$535,995
iii. Agricultural land replacement	No data
iv. Crude palm oil is the cheapest alternative to fossil fuel	$11,889.64286
Total	$569,257.9629

Discounting the costs and benefits

Having priced the costs and the benefits the report looks at the point in time at which the costs and benefits are relevant. The total amount of benefits comes to US$ 569,257.9629. Over time the benefits that remain are the benefit of using the palm oil plantation as a carbon sink reducing greenhouse gas emissions and the relatively low price of crude palm oil. The avoided deforestation is an initial gain. Therefore US$ 21,373.32 is recorded as a one-time benefit at the very beginning in year zero. Sheil et al. (2009) highlights that oil palm mature rapidly. Fruit can be harvested two to three years after planting the seedlings. As there is no estimate given on how long it takes until an oil palm plantation becomes a carbon sink that is capable of absorbing 64.5 t CO_2 per hectare, this report uses three years, the time of the first harvest as proxy for when the plantation reduces CO_2. Therefore, this benefit can only be taken into account from the fourth year onwards but then as a constant benefit in our calculation. Sheil et al. (2009) also states that the palm trees are being replaced after between 25 and 30 years as they reach a height that makes the harvest impossible. This cycle is reported in the calculation. Every 28 years the benefit amounts to zero for three years showing the period of replanting seedlings replacing the older plants. This is also true for the benefit of the low price of palm oil. The amount of US$ 11,889.64286 is a constant benefit during the period of harvest.

The total costs in this analysis amount to US$ 88,268,538.55. The cost of replacing food production with palm oil production in terms of CO_2 is US$ 2603.01, which is an initial cost and therefore is only included in year zero. The cost of land, which amounts to US$ 50,286 is also an initial cost and is also only included in year zero. However, the risk of increased world starvation remains, if the lost food production is not substituted sufficiently. This risk is constant in the cost-benefit-analysis. Another cost that remains constant in our calculation are the subsidies paid by the governments. Therefore the sum of US$ 2500 is included throughout the entire discounting process. The consumer cost of purchasing more expensive palm oil rather than OPEC oil is US$ 13,149.53579. Nonetheless, as the demand for energy is expected to increase by 50% by 2030 (Sheil et al., 2009) and oil reserves are expected to be depleted by 2050 it seems that this cost is only of relevance for the first 37 years in our calculation. Once oil is exhausted palm oil becomes the cheapest alternative to fossil fuel. The costs and benefits are discounted at the rates of 0%, 1.2% and 3.5%. As the impacts of environmental costs are shown far into the future the period looked at is 350 years. The results of these three CBAs come to:

0% → -30,787,025,036

1.2% → -7,285,524,985

3.5% → -2,594,795,218

These are the results of the sum of the discounted or present values of the benefits (PV Benefits) minus the sum of the discounted or present values of the costs (PV Costs) respectively. The social costs exceed the social benefits in all three cases. The calculation summary is shown in tables 4,5 & 6.

Table 4: Discounting Summary 0%

Year	Discount rate	Benefits	PV Benefits	Costs	PV Costs
0-350	0%	• $21,373.32 (0) • $0 (first three years and then every 28 years again for three years) • $535,995 + $11,889.64 (included from the 4th year for 27 years. After three years again 27 years and so on.)		• $50,286 (0) • $2603.01 (0) • $2,500 • $13,149.54 (0-37) • $88.2million	
Total			$172,605,035.8		$30,959,630,071

Table 5: Discounting Summary 1.2%

Year	Discount rate	Benefits	PV Benefits	Costs	PV Costs
0-350	1.2%	• $21,373.32 (0) • $0 (first three years and then every 28 years again for three years) • $535,995 + $11,889.64 (included from the 4th year for 27 years. After three years again 27 years and so on.)		• $50,286 (0) • $2603.01 (0) • $2,500 • $13,149.54 (0-37) • $88.2million	
Total			$40,332,022.99		$7,325,857,008

Table 6: Discounting Summary 3.5%

Year	Discount rate	Benefits	PV Benefits	Costs	PV Costs
0-350	3.5%	• $21,373.32 (0) • $0 (first three years and then every 28 years again for three years) • $535,995 + $11,889.64 (included from the 4th year for 27 years. After three years again 27 years and so on.)		• $50,286 (0) • $2603.01 (0) • $2,500 • $13,149.54 (0-37) • $88.2million	
Total			$13,800,372.88		$2,608,595,591

Key Findings and conclusion

This article has indicated that the price of crude palm oil does not reflect the negative externality that palm oil production may create, namely the reduction in available land for food production and thus an increased threat to food security, higher food prices and malnutrition. The results of the three CBAs conducted support this hypothesis. The results imply that palm oil production should not replace food production. Agricultural land should be used to secure global nutrition. Biofuels and especially palm oil are not desirable fossil fuel substitutes as they threaten global food security and damage the environment.

There are various regulatory responses open to governments to ensure that CPO is priced in a way that reflects its negative externalities. Casson (1999) highlights the rather corrupt development of land allocation and land sales in Indonesia, where local landowners feel that they have been tricked into selling their land under unclear conditions. This indicates that the “real” price for the land ought to be much higher. A clear policy recommendation, therefore, is the price at which land or licenses are sold is reviewed. Alternatively, producers of palm oil could be taxed, a so-called ‘Pigovian tax’, so that the cost to the consumer reflects ‘real’ costs; or again that importers of CPO impose levies. Governments could provide subsidies for food production,

The recommended policies mentioned here do not tackle the problem of future energy supply nor of reducing greenhouse gas emissions. However, many authors now argue that much bigger potential to reduce carbon emissions and resolve future energy needs lies in focusing on conservation and saving energy (Harris, 2006; MacKay, 2013). The quick-fix solution of biofuels needs to be reviewed and a more serious and far-reaching review of current energy use and production undertaken.

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