PROF. DR. DR. H.C. P. MICHAEL SCHMITZ
INSTITUTE FOR AGRICULTURAL POLICY
AND MARKET RESEARCH
JUSTUS-LIEBIG UNIVERSITY GIESSEN
AND INSTITUTE FOR AGRIBUSINESS

Preliminary STUDY

DETERMINATION BASIS FOR THE LEVEL AND VOLATILITY OF AGRICULTURAL COMMODITY PRICES IN INTERNATIONAL MARKETS **– IMPLICATIONS FOR WORLD NUTRITION AND POLICY FORMULATION –**

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DETERMINATION BASIS FOR THE LEVEL AND VOLATILITY OF AGRICULTURAL COMMODITY PRICES IN INTERNATIONAL MARKETS – **IMPLICATIONS FOR WORLD NUTRITION AND POLICY FORMULATION** –

PRELIMINARY STUDY

on behalf of the Verband der Deutschen Biokraftstoffindustrie e. V. and the Union zur Förderung von Öl- und Proteinpflanzen e. V.

by **Prof. Dr. Dr. h.c. P. Michael Schmitz**
Institute for Agricultural Policy and Market Research
Justus-Liebig-University Giessen
and Institute for Agribusiness

VDB
Verband der Deutschen Biokraftstoffindustrie e. V.
- Association of the German Biofuel Industry -
Am Weidendamm 1A
D-10117 Berlin
www.biokraftstoffverband.de

UFOP
Union zur Förderung von Oel- und Proteinpflanzen e. V.
- Union for the Promotion of Oilseeds and Protein Plants -
Haus der Land- und Ernährungswirtschaft
Claire-Waldoff-Str. 7
D-10117 Berlin
www.ufop.de

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STRUCTURE OF THE PRELIMINARY STUDY

1 PROBLEMS AND QUESTIONS

Since the agricultural price explosion of 2007/08 for basic foodstuffs and the subsequent decline in 2009, intense discussions have commenced concerning the potential negative consequences of high and volatile prices for world nutrition. Especially in countries that import foodstuffs, violent protests erupted against the drastic inflation of foodstuffs affecting, above all, the urban population. And the recurring price high in 2010/11, which is still on-going, has reencouraged this discussion, whilst also triggering political reactions. Thus export restrictions have been imposed in many exporting developing and transition countries, which has intensified the price rise yet further at the expense of the importing nations. Insofar as exports have been fixed in terms of quantity, this has also led to more volatile agricultural commodity prices. The G20 Group therefore agreed at the meeting in November 2011 under the presidency of the French that agricultural commodity markets require greater regulation, while proposing measures for curbing prices and hence supposedly safeguarding world nutrition. The French president, in particular, continues to see the main cause of volatility and overheated markets with record prices as lying in speculation. As a result, price and position limits as well as increased regulatory capital requirements for commodity future markets, for example, have meanwhile also been put into place in the EU against this background. Above all, banks, index funds and hedge funds are in the crossfire of criticism (SCHUMANN, 2011; Wirtschaftswoche, Nov. 2011).

Public and published opinion also appears to clearly point the finger at other guilty parties. The UN special correspondent de SCHUTTER, for example, maintains that the biofuel subsidy destroys the rainforest and drives food prices higher (Agra-Europe, Nov. 2011). And the Welthungerhilfe together with IFPRI clearly determine the following in their report on the World Hunger Index: “Biofuels are the main cause for higher and more volatile agricultural prices” (Oct. 2011). Contrary to this somewhat general fingerpointing, extensive literature on the factors determining the price level and price volatilities of agricultural commodities has meanwhile been published, which presents a somewhat more differentiated picture than the current discussion.

In this context, it is also interesting to mention that almost the entire agricultural economy and virtually all prominent institutions such as the World Bank, OECD, FAO and IFPRI looked at things entirely differently until 2007/08. Until then, it was believed that low world market prices for agricultural commodities, above all caused by protection and excess production in the industrialised countries, destroy the production fundamentals in poor countries and contribute significantly to hunger and poverty (cf. SWINNEN, 2011). Whether high or low agricultural prices now exacerbate the hunger situation has since then been an open question and also calls for a differentiated way of looking at things (cf. FAO, 2011). In light of these circumstances, the following questions are addressed in the following article:

- How have the levels and volatilities of agricultural commodity prices and the markets for biofuels developed and what do the current forecasts say?
- What factors contribute significantly to the pricing in international agricultural commodity markets, more precisely in respect to the level of prices and their volatility?
- Approximately what quantitative share do the individual factors contribute? What share do international biofuel subsidies have and how much is the pure oil price rise responsible for the price effects of agricultural commodities.
- How are price effects for agricultural commodities on the world markets transferred to the domestic markets of developing countries.
- What are the main causes of hunger and poverty in developing countries and what role do higher and more volatile prices play on world agricultural markets, if at all?

These five questions will be addressed as part of an analysis of the more recent relevant literature. In addition to this, integral simulation calculations are performed with the partial multiple-region multiple-product equilibrium model AGRISIM. **CHAPTER 2** initially provides a market overview concerning the price development for agricultural commodities and the biofuels themselves. In **CHAPTER 3**, the causes of high and volatile agricultural commodity prices are discussed and the quantitative contribution of the biofuels and their subsidies are estimated.

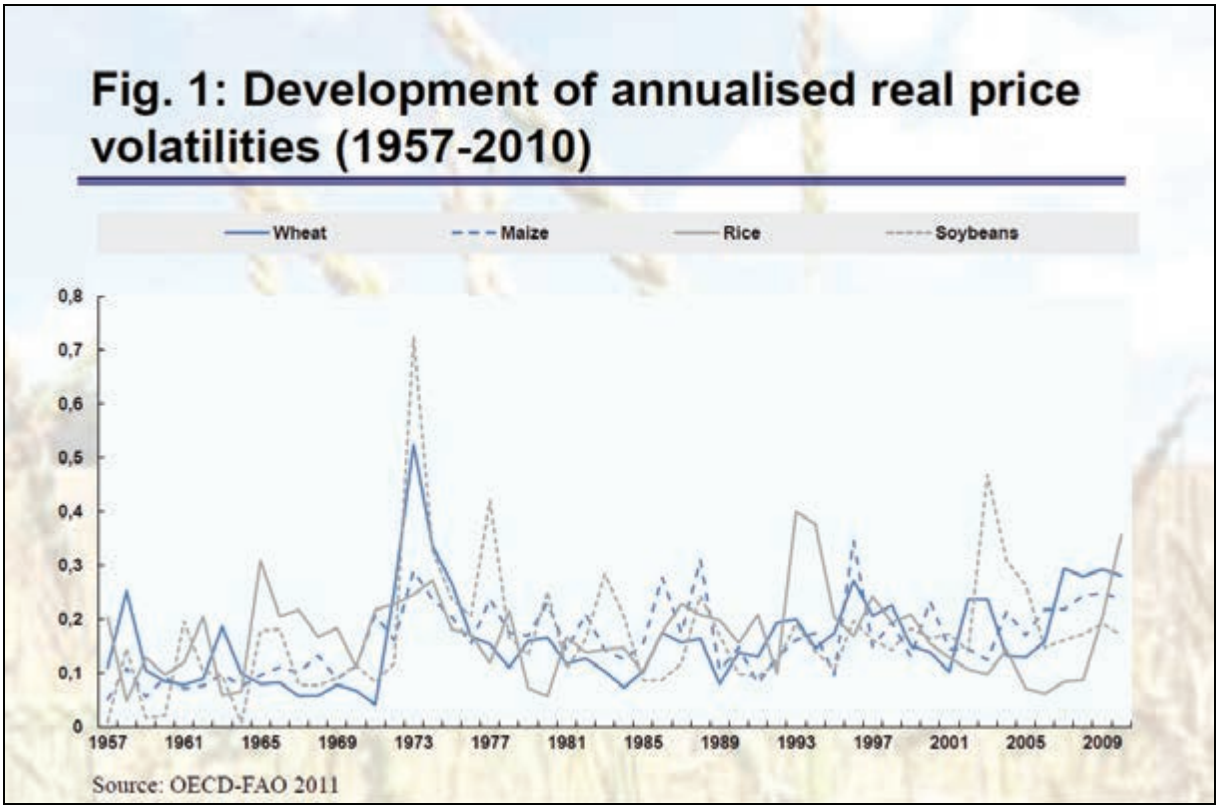
CHAPTER 4 deals with the main causes of hunger and poverty and the potential consequences of higher and more volatile prices on the world markets for the hunger and poverty situation on the domestic markets of developing countries themselves.

The study concludes in CHAPTER 5 with some considerations and conclusions for policymaking.

2 AGRICULTURAL COMMODITY PRICES AND BIOFUELS – A MARKET OVERVIEW

2.1 DEVELOPMENT OF PRICE VOLATILITIES AND PRICE LEVELS

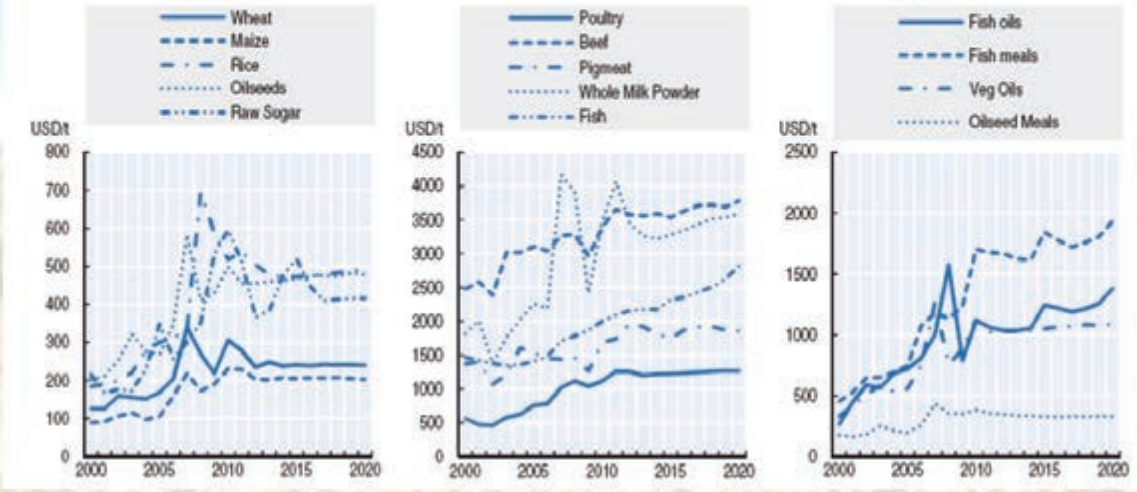
To begin with, the question should be addressed as to whether the price volatility in agricultural commodity markets has increased and how the volatility is expected to develop in future. A look at Figure 1 reveals that no significant trend towards higher volatility for the four products in question can be determined long-term. At most, slight level differences can be observed. Thus the volatility in the 1950s and 1960s was somewhat less on average at 10% to 15% than in the 1970s. Since then, it has persisted with slight fluctuations upwards and downwards on a somewhat higher level on average of approx. 20% to 25% with a further slight rise in the last decade to 2010. Nevertheless, a clear upwards trend cannot be determined. How the development will continue is disputed in the literature and among experts. The observable climate change with an increase in the frequency, extent and duration of weather extremes and resultant yield risks argues in favour of greater price fluctuations. The increasing international exchange of commodities entails new risks in the area of plant and animal diseases. On the other hand, greater price stability can be expected from the international removal of protections and further liberalisation steps within the framework of the WTO, because more open markets provide a greater buffering volume in the event of supply and demand shocks. What influential factor may ultimately predominate remains unclear at present. Lower volatilities are certainly not to be assumed in future, and the entire branch would be well advised to expect such risks in future and utilise all available risk management instruments.



This applies in particular for EU agriculture and its market partners, who have been confronted with increasing price volatility in the EU agricultural markets for some years as a result of the gradual liberalisation of the market regulations and have meanwhile reached the volatility level of world markets for the most important products (cf. von LEDEBUR, 2010 and O'CONNOR and KEANE, 2011). Administered market prices that are essentially stabilised through intervention, threshold and guide prices are therefore a thing of the past. The state mandated risk management collectively uniform for all companies due to market regulations must therefore be replaced more in the future than beforehand by means of an individual risk protection to be applied to the risk aversion, risk exposure and location prerequisites of the businesses. Examples of this can be found in Box 1, which distinguishes business-internal and business-external risk management instruments.

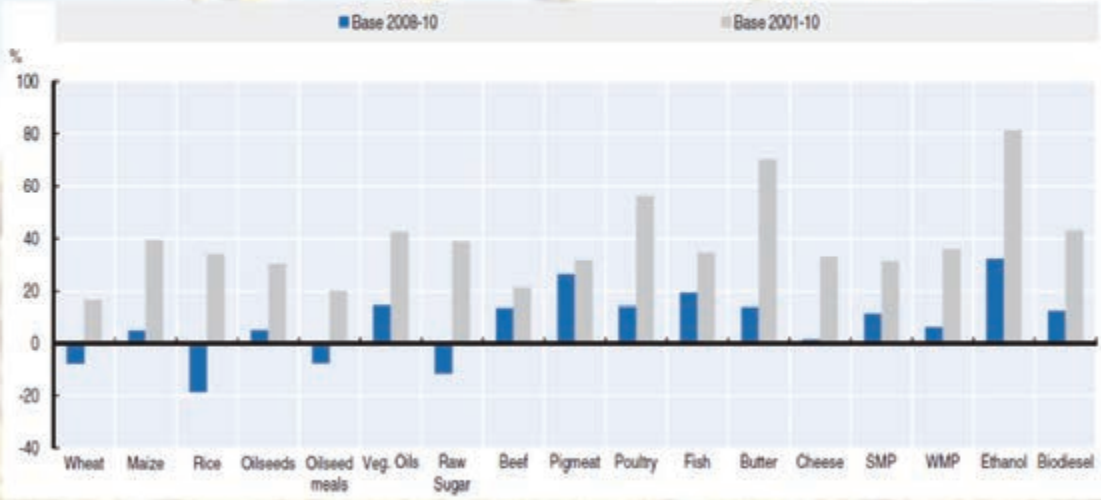
A more uniform picture becomes apparent when it comes to the development in the long-term level of agricultural commodity prices. Most research institutes expect a rise in the prices over the next decade until 2020 in comparison to the previous decade since 2000. Figures 2 and 3 show these developments for selected agricultural products. Particularly high price rises for maize, rice, vegetable oils, cane sugar, poultry and butter are to be expected. And even in comparison to the time period 2006-2010, a price rise is estimated for 13 out of 17 products. Biofuel prices are also set to rise significantly when comparing the decades, the figures being an 80% increase for ethanol and 45% for biodiesel (cf. Fig. 4).

Fig. 2: Development of agricultural commodity prices 2000 – 2020

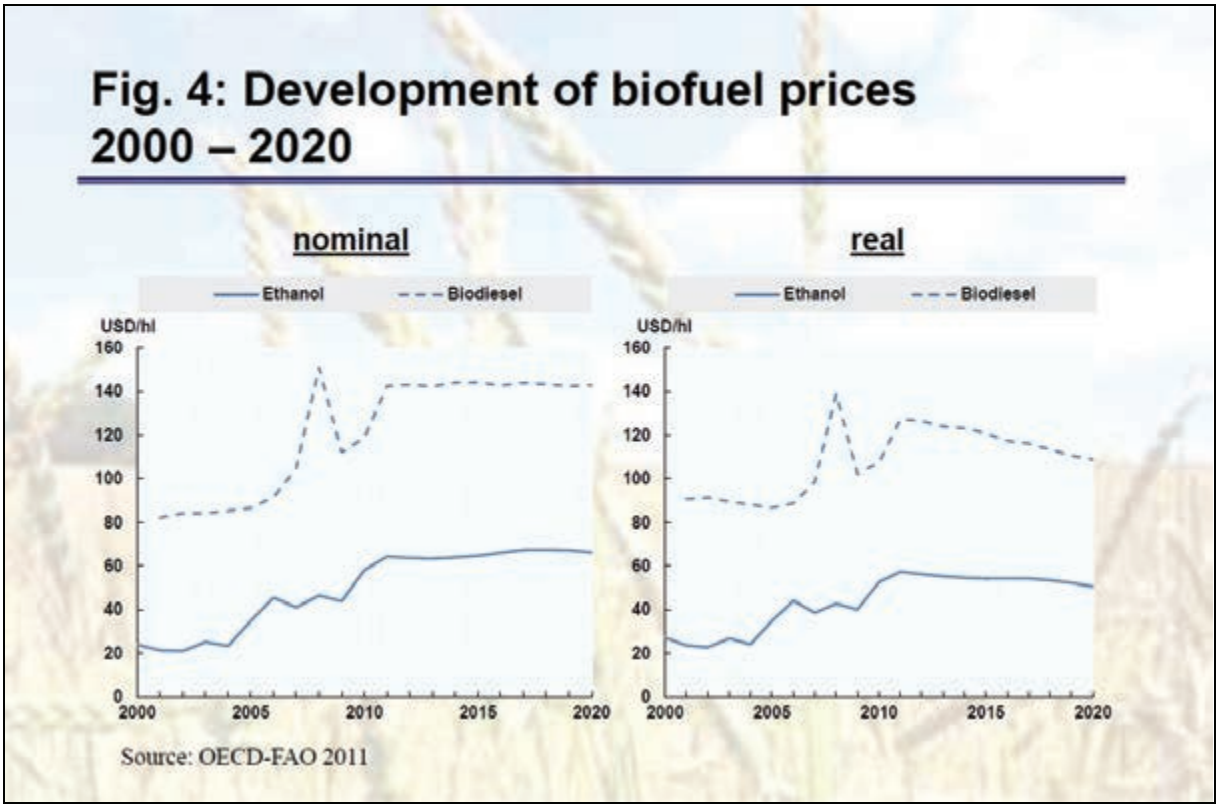


Source: OECD-FAO 2011

Fig. 3: Price rise in the decade 2011-2020 compared to the baseline period



Source: OECD-FAO 2011



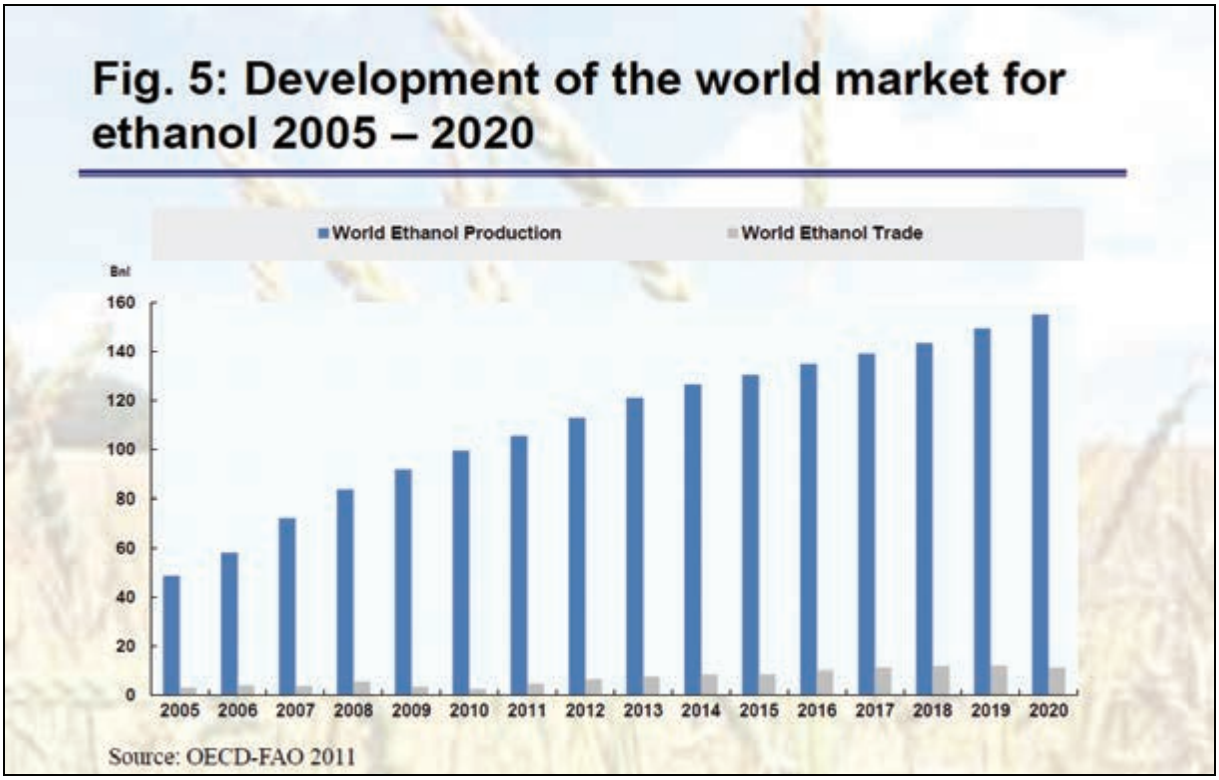
In summary, it can be determined that

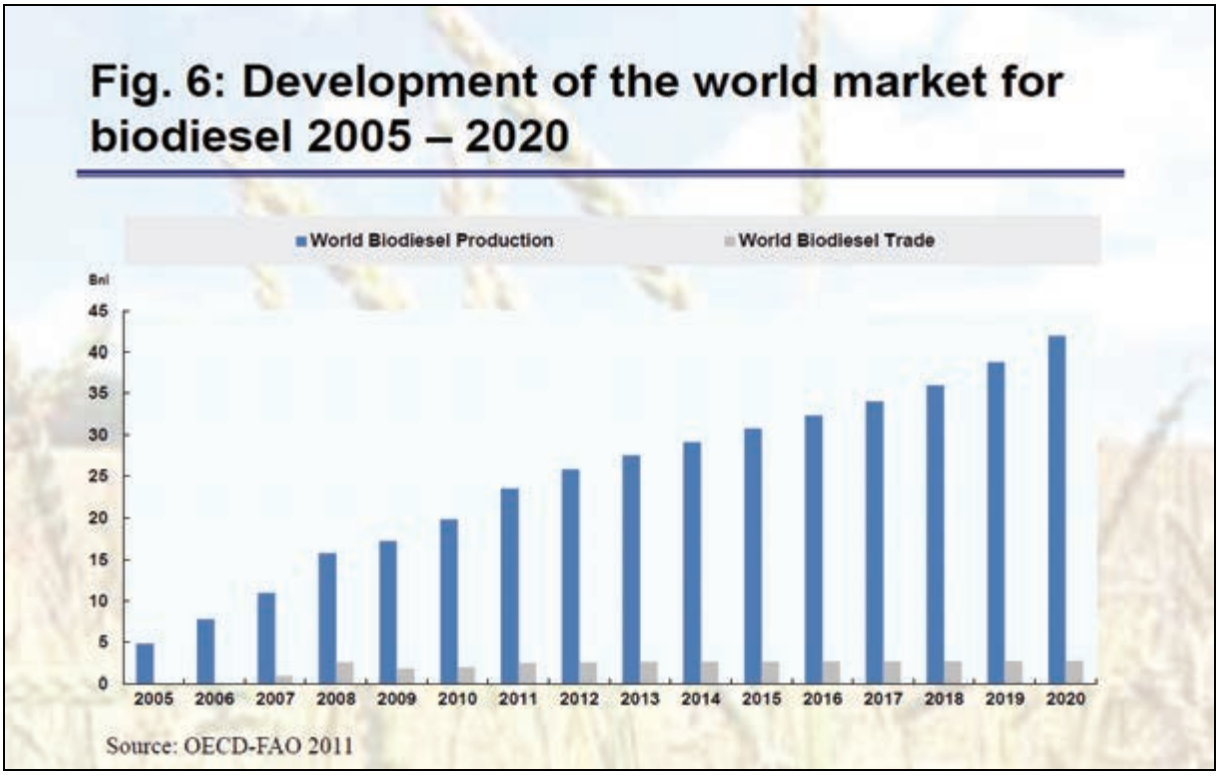
- the significant price fluctuations of the last five years in the long-term consideration are no exception and so an upwards trend in the volatility is not to be identified;
- but lower volatilities than previously are not to be expected in future;
- the price level for agricultural commodities and biofuels will exhibit a rising trend;
- industrialised and developing countries will have to get used to continued volatile agricultural commodity prices at a higher level and their businesses should adapt correspondingly.

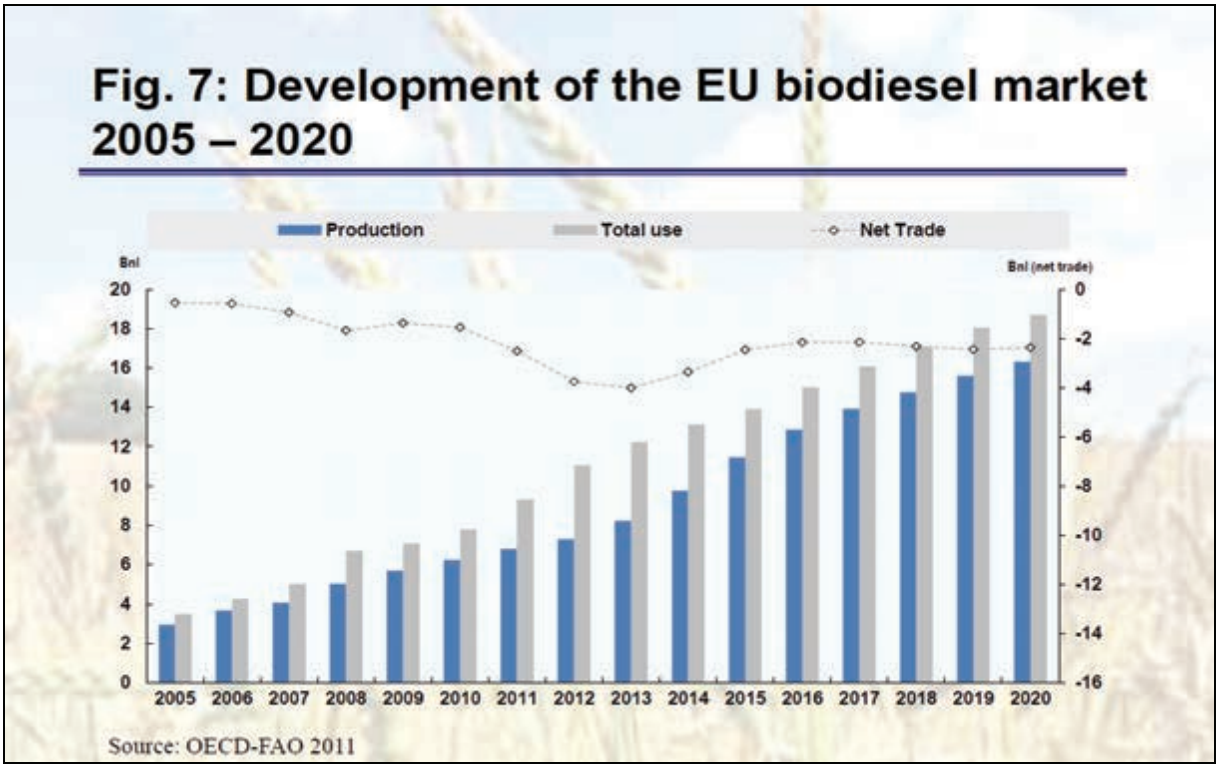
2.2 DEVELOPMENT OF THE BIOFUEL MARKETS

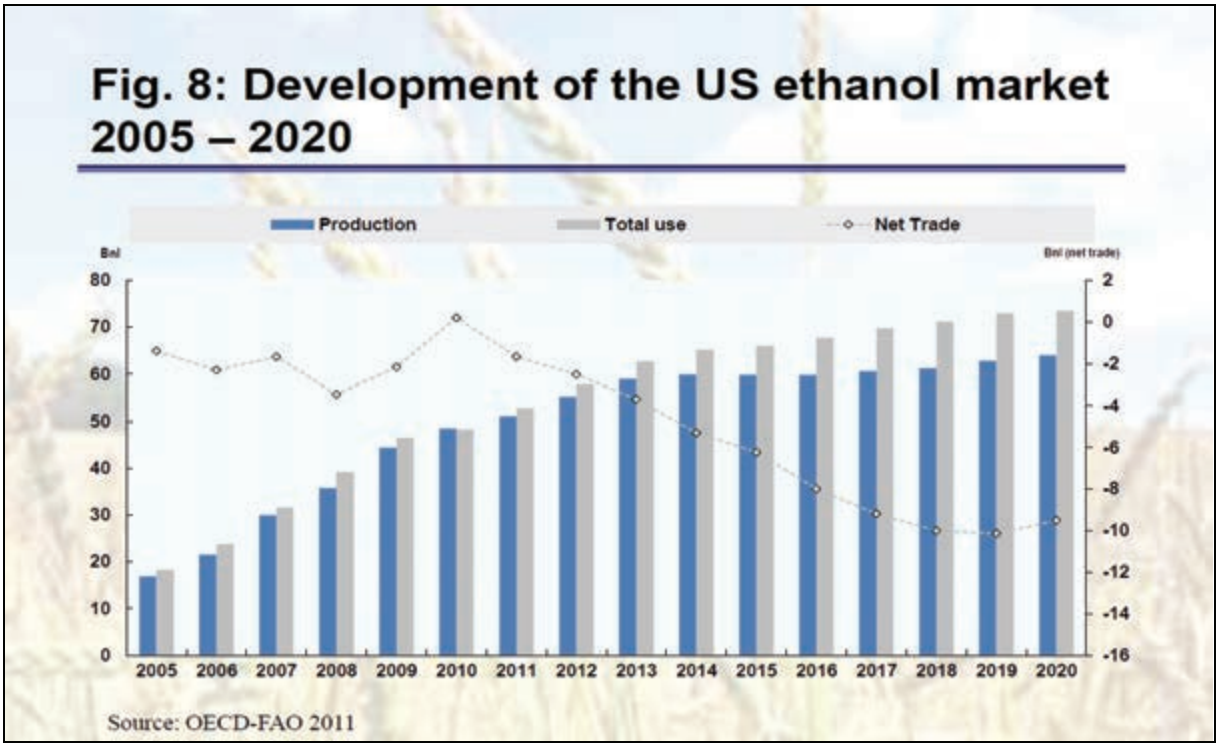
A look at Figures 5 and 6 shows that the growth dynamics in the world production of ethanol and biodiesel will continue until 2020, more precisely by over 200% in comparison to 2005 for ethanol and by over 700% for biodiesel. However, the global trade in biofuels is rather insignificant when measured in respect to the production level. The largest producer and consumer in the biodiesel market is, without doubt, the EU, for which an import demand of 2 to 4 billion litres is forecast (cf. Fig.7). Major

exporters in this context are Argentina, Malaysia and Thailand. The largest producer and consumer of ethanol, on the other hand, is the USA after Brazil (cf. Fig. 8 and 9). Whilst the USA will certainly develop an ever greater import demand in the forecasting period, Brazil will significantly expand its ethanol exports to over 9 billion litres.



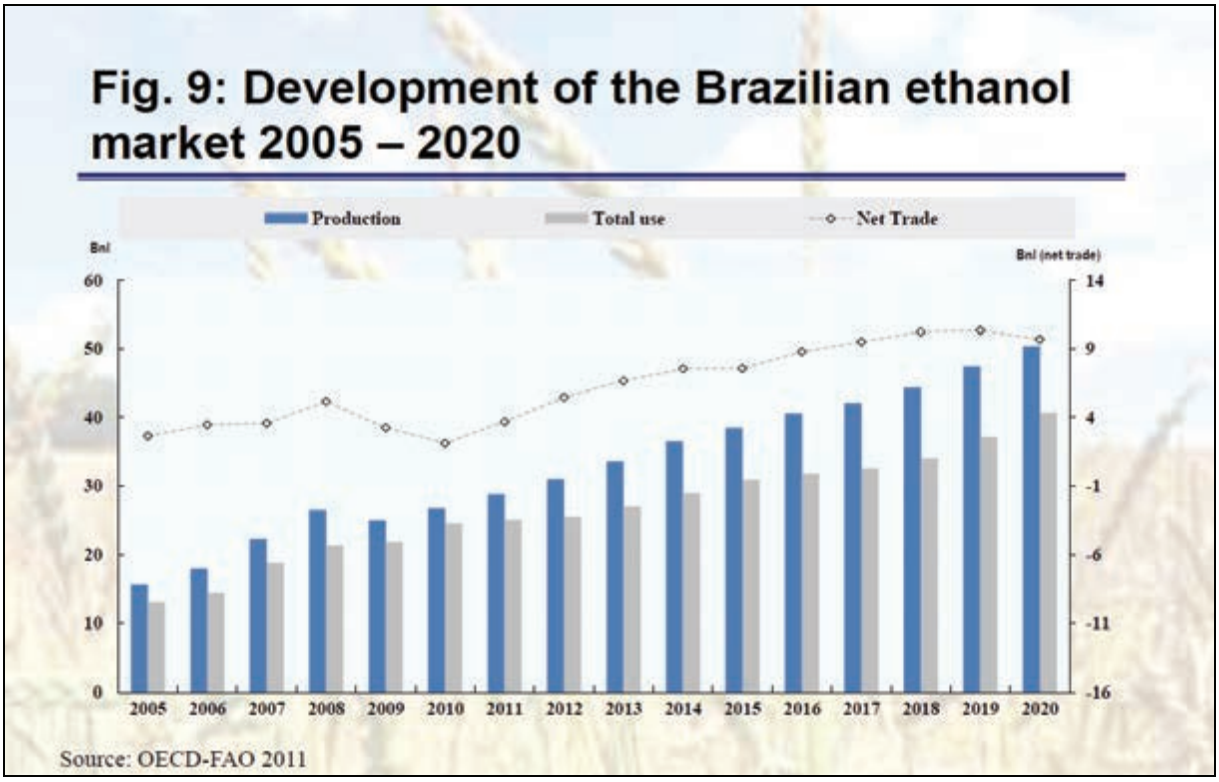


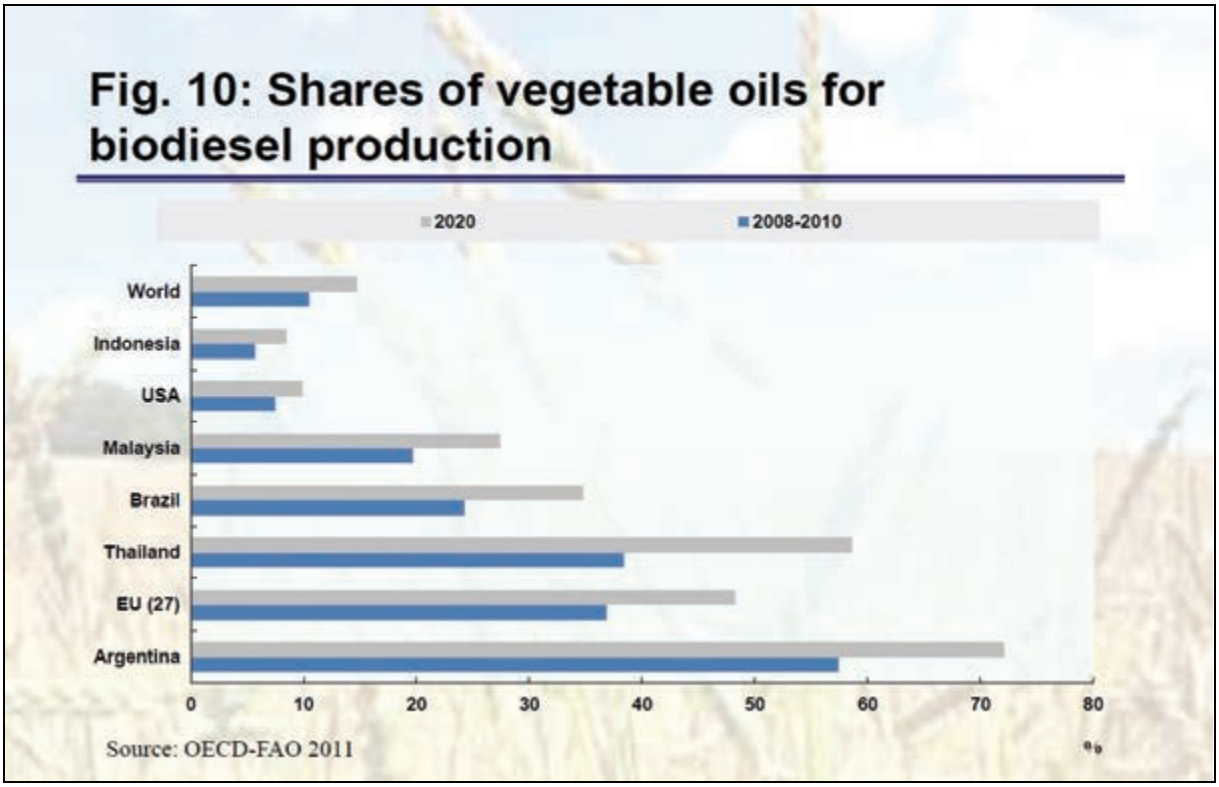


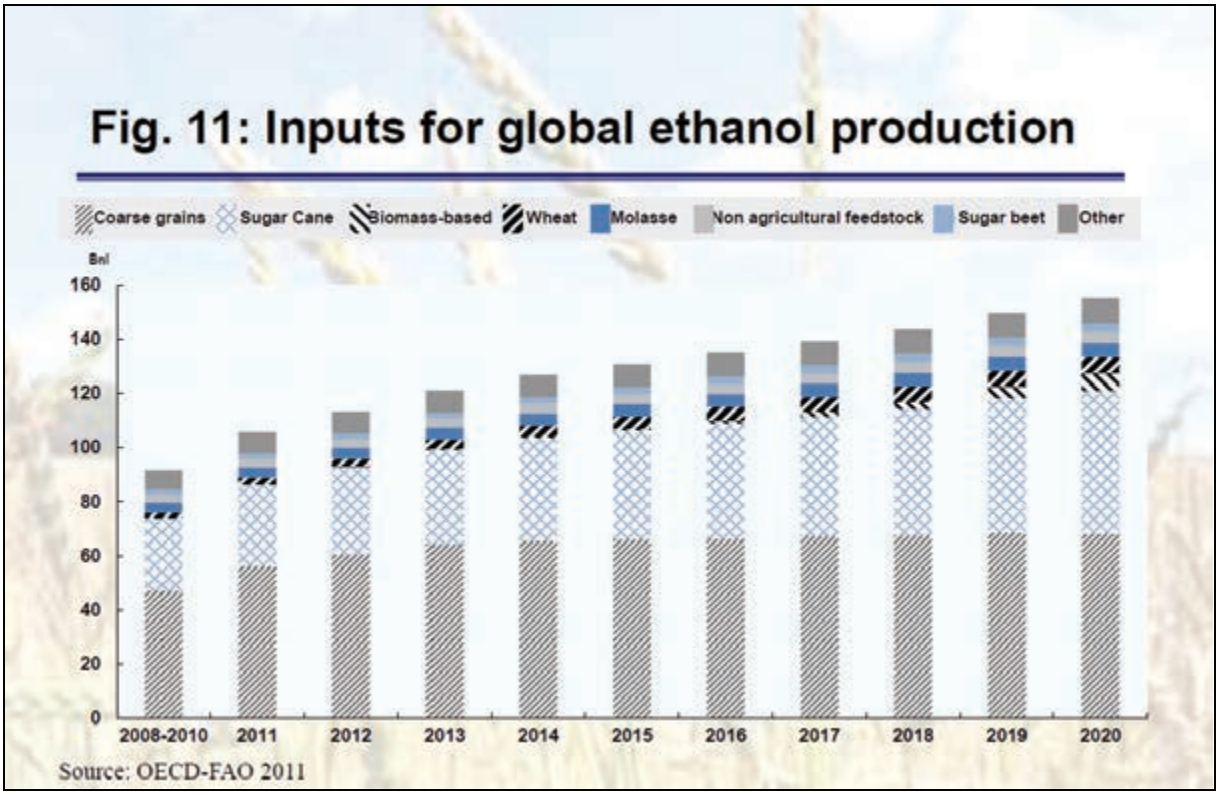


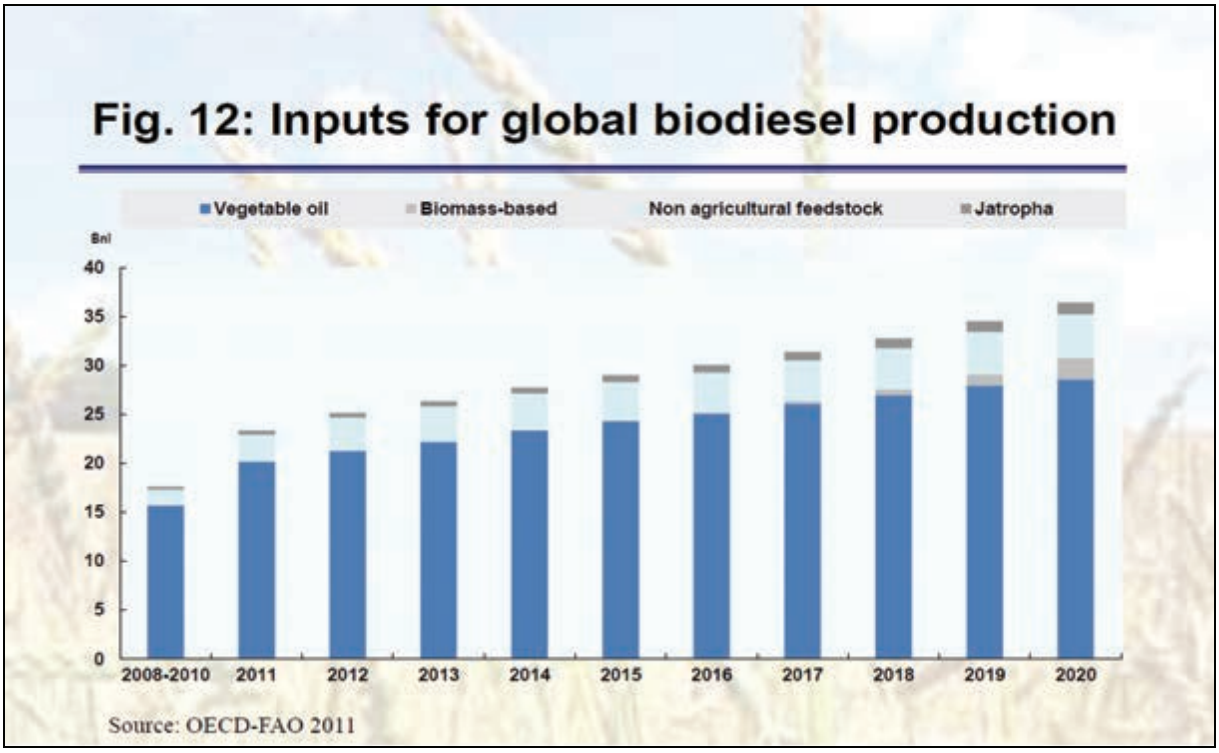
More than 75% of world biodiesel production will come from vegetable oils in 2020, this being around 16% of the total demand for vegetable oils. An even greater share of vegetable oils will be used in the EU-27 (just under 50%) and Argentina (over 70%) for biodiesel production in 2020 (cf. Fig. 10 and 12). Feedgrain and sugar cane, on the other hand, are the main inputs for ethanol production (cf. Fig.11). In 2020,

44% of ethanol is expected to be produced from feedgrain and 36% from sugar cane. All other inputs only play a subordinate role. In the USA, just under 40% of maize production is used for ethanol production and in Brazil approx. 50% of sugar cane production goes into ethanol production. This brief overview of the global market situation for biofuels may suffice here.









It remains to be stated that despite some uncertainties regarding biofuel policies, macroeconomic framework conditions and crude oil prices, a further significant growth in biofuel production is anticipated. According to this, in 2020, 12% (2008-10: 11%) of the feedgrain and 33% (2008-10: 21%) of world sugar cane production will

go towards ethanol production and 16% (2008-10: 11%) of vegetable oils will go into biodiesel production.

3 CAUSES OF HIGHER AND MORE VOLATILE AGRICULTURAL COMMODITY PRICES

It shall be clarified below what main determinants fundamentally affect the price developments in the world markets for agricultural commodities and in what direction, what quantitative effect the individual determinants presumably have and what role biofuels play here. To this end, a brief overview will be provided of more recent publications, after which a partial equilibrium model will be used to simulate what price effects would result, all things being equal, if there had not been the additional demand production of biofuels for the 2008-10 period.

3.1 LITERATURE OVERVIEW

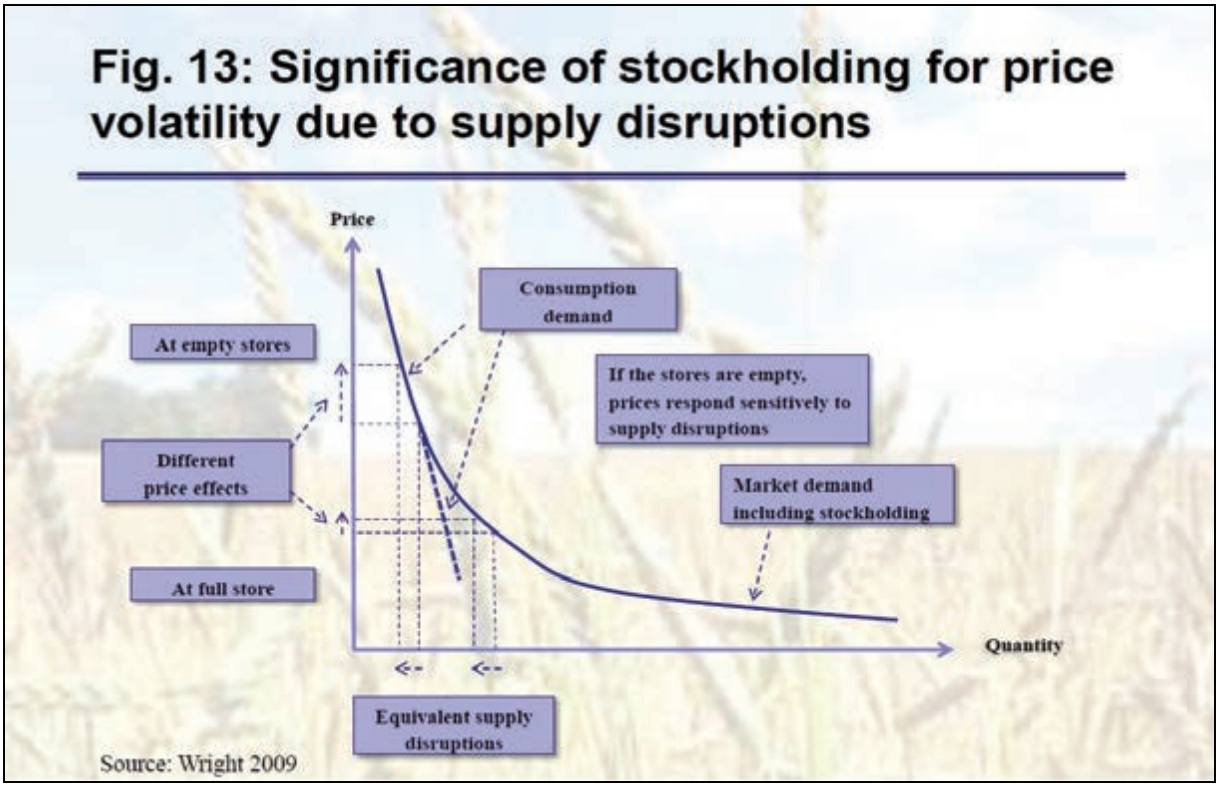
The more recent literature discusses a whole series of influential factors on the price developments in the world market for agricultural commodities (cf. Box 2). The weather certainly plays a central role here having significantly influenced agricultural production and markets in the past five years as a result of climate change. Thus the price peak of 2007/08 is certainly also due to harvest losses on several continents at the same time and the price drop of 2009 was preceded by two record harvests. Finally, drought and floods in 2010/11 caused a renewed price high for numerous agricultural commodities. The weather is therefore evidently a primary factor in explaining price volatility both in the high-frequency and low-frequency range, i.e. in the fluctuation range from less to more than one harvest year (cf. ROACHE, 2009 and cf. Fig. 14). Besides the weather, other factors include animal and plant diseases that have turned out to be a new source of risk amid ever more intensive commodity exchanges worldwide and which can lead to hefty price reactions on the supply and demand side.

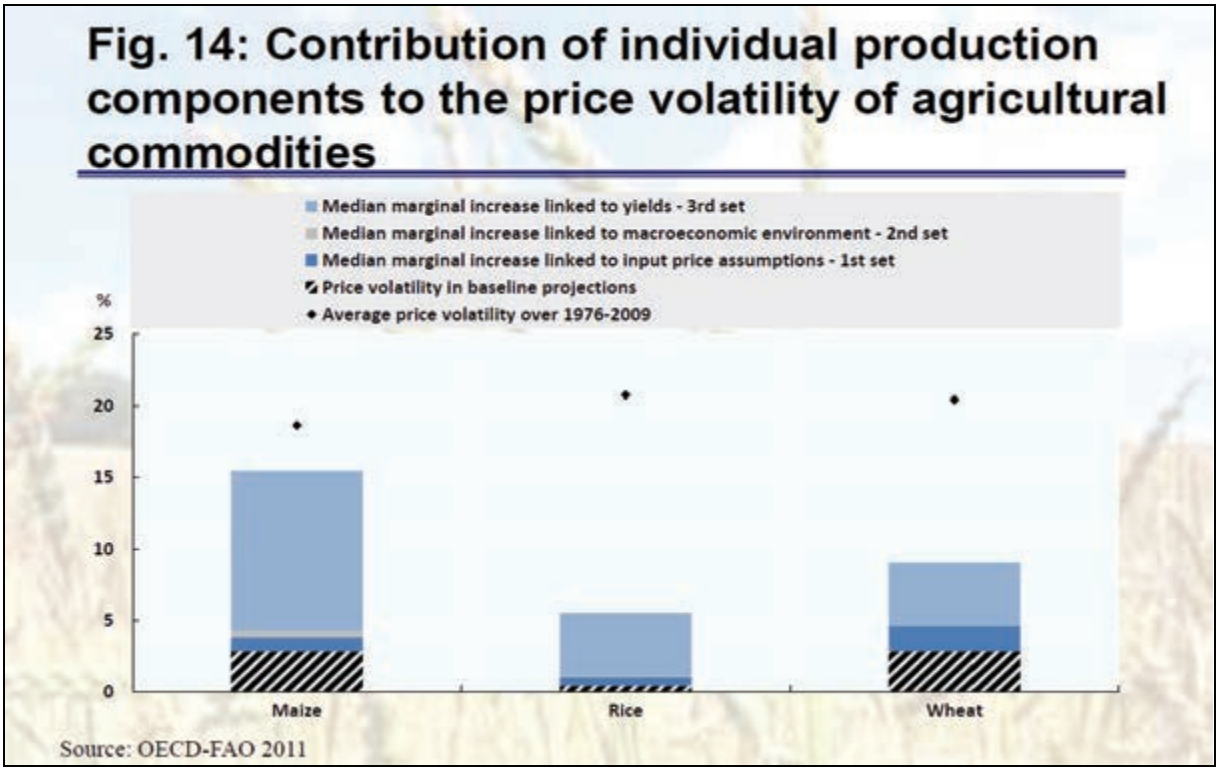
Box 2: Potential determining factors for high and volatile agricultural commodity prices

- Weather, climate change, plant and animal deseases
- Stock levels and thin markets
- Exchange rate (weak Dollar)
- Oil prices, interest rates, inflation and freight costs
- Land and water shortage
- Population and income growth
- Altered dietary habits
- Falling yield growth
- Trade restrictions
- Financialisation of the agricultural markets, speculation
- Biofuels and subsidies

Whether prices react to such shocks or different shocks in an extreme or moderate manner primarily depends on the stock to use ratio. In the case of low stocks, markets respond extremely nervously to production failures or abrupt surges in demand with excessive prices. This was typically the case in 2007/08. Figure 13 explains this situation. The steep linear demand curve including the dotted part represents the pure consumption demand e.g. for cereals. As a basic foodstuff, the demand curve exhibits an inelastic progression, as expected. In the event of falling prices, however, an increasing tendency towards speculative stockholding demand ensues, with the expectation of being able to sell the commodity later at a higher price. This makes the demand curve in the lower area more elastic. If unexpected shocks in the supply now occur, these cause very different price effects even in the case of equivalent quantity changes (cf. Fig. 13). In the case of empty stores, supply shortages lead to extreme price fluctuations upwards, while only low price rises are to be noted when stores are full. It is therefore not surprising that numerous examinations reveal a close negative correlation between price level and stocked level (or more precisely “stock to use ratio”), without the causality link clearly being explained by this (cf. WRIGHT, 2008 and 2009, and BOBENRIETH and WRIGHT, 2009). If stocks are at the lower limit for a longer time period, price volatility will also rise in the event of persistent supply and demand shocks. Knowledge of private, state and semi-stage stockholding activities and quantities therefore also plays a

critical role in predicting future price volatilities. These have not been recorded properly until now. The establishment of greater transparency in this area could make an important contribution to stabilising world markets.





Occasionally, the existence of thin markets is made responsible for price volatilities (cf. TANGERMANN, 2011). The term “thin” markets is used if the trade volumes only account for a small share in comparison to word supply and world demand. However,

more intense price fluctuations only occur if the domestic markets are decoupled from the world market at the same time and signals from there only lead to minor supply and demand responses. Import demand and export supply elasticities are then especially low, with shocks being reflected in intense price movements.

The macroeconomic factors affecting agricultural commodity prices without doubt include exchange rates, interest, inflation and money supply as well as oil prices, freight rates and the growth rates in income. In the form of real income rises, the latter have the long-term effect of increasing the demand for agricultural commodities and, together with population growth and altered dietary habits through to increased consumption of animal products, are an important reason for explaining the continuous price level rise expected in future. However, price volatility in the low-frequency range is affected if the gross domestic product of the most important trading nations fluctuates due to economic factors, thereby exceeding definite upper and lower limits of change rates, as in the previous financial crisis of 2009 (cf. GILBERT, 2008).

Rising oil prices have a dual effect on agricultural commodity prices. On the one hand, they make the inputs of agriculture and the food industry more expensivee, e.g. in the form of energy, freight costs and fertilizers. On the other hand, they render the use of bioenergy more attractive. In terms of supply and demand, agricultural commodity prices are therefore driven upwards, a close correlation to the agricultural commodity prices resulting purely statistically from a certain crude oil price. The OECD/FAO estimate that a 10% oil price rise will lead to a 2.3% rise in wheat prices and a 3.3% rise in the maize and vegetable oil prices (cf. OECD-FAO, 2008).

A significant effect on the agricultural commodity prices is also to be expected from exchange rates, which are usually priced in dollars in international commerce. If the dollar loses value in comparison to the currencies of the main trading nations, i.e. if their currencies become stronger, this results in a retention of export supply and a stimulus in import demand, with the effect of a worldwide price rise, as possibly occurred in the devaluation phase of the dollar in the time period 2002 to 2008. TANGERMANN (2011) estimates the exchange rate price elasticity for this time period as 0.1 to 0.3, i.e. a 10% dollar devaluation would lead to a 1 to 3% price rise.

MITCHELL (2008), however, even concludes an elasticity of 0.75 in his empirical analysis. The OECD estimates it to be 0.5.

Not least, the lax monetary policy of the USA has pushed interest rates to an historic low and flooded national economies with high liquidity. In the event of higher inflation at the same time, a flight to material assets and commodities is presumed and hence also an increase in demand for agricultural commodities. However, this chain of argumentation is not entirely conclusive, because a physical multiple demand for stockholding agricultural commodities would have to be associated with this, which did not occur in the time period from 2002 to 2008. In contrast, the stockholding dropped to historic lows. And a multiple demand for financial products in the agricultural commodity area has clearly had no or hardly any effect on the spot markets (cf. section on the financialisation of the agricultural markets).

Nevertheless, in the long run, the internationally rising shortage of land and water will not be insignificant on the supply side. Rising lease and land prices coupled with increased commitment to direct investments in land (verified on the one side with the term "land grabbing") are clear indications for this. Water is not scarce everywhere, but in developing countries in particular, a serious shortfall is looming in the next few years, quite apart from the problems with water quality. As central input factors of agricultural production, this shortage will also be reflected in higher agricultural prices, ceteris paribus. The tendency for yield increases to decline since the 1960s in regard to important plant species for nutrition, such as wheat, maize and rice, will also tend in the same direction, unless a second green revolution reverses the trend.

The significance of unexpected ad-hoc export restrictions and ease of importations in the event of rising prices for agricultural commodities, as could be observed in numerous countries during the price peaks of 2007/08 and 2010/11 are emphasised by most authors. As with the oil price, these measures result in a dual effect. On the one hand, export restrictions and ease of importations lead to increased scarcity in the world markets, driving the price level even higher. On the other hand, such ad-hoc interventions reduce export supply and import demand elasticities and hence cause higher price fluctuations in the event of any supply and demand shocks. The effect on price volatilities is therefore quite similar to the influence of low stockholding

quantities. Both phenomena reduce elasticities in the world market and lead to greater instability in the event of disruptions.

3.2 Speculation and Biofuels as Scapegoats

A number of authors hold the financialisation of agricultural markets responsible for high and volatile agricultural prices (SCHUMANN, 2011 and BASS, 2011). Above all, speculators, banks, index funds and hedge funds are in the crossfire of criticism. How is the situation now in regard to speculation on commodity future markets or the increasing commitment of index funds to commodity future markets? Do these result in destabilising effects on commodity future prices and then eventually spot prices in the real markets? In fact, doubt has been cast on this hypothesis (cf. SCHMITZ and MOLEVA, 2011). The structure of the stakeholders on the spot markets for agricultural commodities (= real markets) has not essentially changed in the past few years. In the commodity future markets, on the other hand, there has actually been a significant increase in institutional investors (e.g. index funds and hedge funds). However, a clearly destabilising effect on commodity future and spot markets of agricultural commodities could also be so little demonstrated empirically as an adverse effect of the traditional functions of commodity future markets, namely risk hedging and price prediction. In contrast, various empirical studies reveal that the involvement of institutional investors safeguards the necessary liquidity for short hedging and even stabilises forward prices. Even where contrary empirical results are derived, authors are very cautious in the interpretation, stressing the provisional nature of the analysis (cf. ROBLES et al. 2009 and 2010).

The division of commodity future market participants into speculators and hedgers is regarded as exaggerated. Hedgers also sometimes speculate, and speculators occasionally hedge. Index funds, for example, enter commodity future markets in order to diversify their portfolio, because commodity markets and equity markets are not correlated. The increased share of index funds in commodity future markets preceded the price boom of 2007/08 by the significant time frame of two and a half years, which means it cannot be the cause. Moreover, price explosions also occurred in commodity future and agricultural commodity markets in which index funds are not involved at all, for example for rice, and also in commodity markets, where no commodity future markets exist at all, such as for apples, onions and beans.

Various empirical studies finally reveal that there is no significant effect by speculation and the involvement of index funds in commodity future markets on volatility and the level of forward prices and spot prices. The current fundamental factors are crucial for the spot prices, while the expected values of the fundamental factors are definitive for the forward prices. Only when new information is available do the forward prices change, and not because index funds go “long”. Every long transaction is accompanied by a corresponding short-hedge transaction. Index funds and speculators therefore ensure the necessary liquidity for safeguarding the price risks, which are then obviously estimated higher by farmers, dealers and processors as well. It is therefore also incorrect to maintain that the contract volume of agricultural commodities extending far beyond the physical volume is responsible for the price instability. It only reflects the safeguarding need of hedgers, which could not be realised without speculation (cf. also TANGERMANN, 2011; IIF, 2011; SANDERS/IRWIN, 2010; Wiss. Beirat, 2011).

Finally, biofuels and their funding are also singled out for criticism. In this context, it is not disputed that an additional demand for agricultural commodities for the production of biofuels has a price boosting effect in comparison to a situation without the existence of such fuels ceteris paribus. Secondly, fixed blending quotas in conventional fuels undeniably lead to lower demand elasticities and hence higher price volatilities during all shocks. An influence on the price level and price fluctuations cannot therefore be assumed. We are thus left with the question as to whether this influence is quantitatively significant or rather insignificant and how it behaves in relation to the other factors. In this regard, the literature offers a whole spectrum of empirical results, which deduce one thing or another (cf. Box 3). These range from an estimated 66% or 30% contribution to the price rise by MITCHELL (2009) and ROSEGRANT (2008) to the statement of very low effects below 10% (von WITZKE, 2011 and EU-KOMMISSION, 2010) or hardly noticeable effects on the price level by GILBERT (2010) and BAFFES/HANIOTIS (2010). In the meantime, there are numerous publications based on partial and general equilibrium models, which arrive at results between 10% and 30% for the price effect of biofuels. This is also the conclusion of TANGERMANN (2011) for the time period from 2006 to 2008, which also states that the debate on this is not yet over and it is probably impossible to precisely determine the exact price effect in the context of all other influential factors.

Box 3: Selected quantitative analyses for the influence of biofuels on agricultural commodity prices

Authors	Contribution to the price rise
Mitchell (2009):	66% between 2002-2008
Rosegrant (2008):	30% between 2000-2007
Wright (2009):	substantial price effect due to biofuels
USDA (2008):	13% to 18% between 2007-2008
Taheripour (2008):	9% to 16% between 2001-2006
FAO (2008):	7% to 15% between 2008-2018
OECD (2008):	5% to 16% between 2008-2018
Banse (2008):	7% to 12% between 2008-2020
EU Commission:	3% to 6% (only for cereals) to 2020
von Witzke (2011):	0.1% bis 4.6% between 2007-2008
Gilbert (2010):	hardly any effect by biofuels
Baffes/ Haniotis (2010):	hardly any effect by biofuels
Tangermann:	10% to 30% between 2006-2008

„…still a matter of debate and probably impossible to quantify the precise price effect."

But how can we now explain such considerably different results? A more precise analysis of the relevant literature yields the following indications:

- The length of the period under review plays a crucial role. In the case of longer time periods, more elastic adaptation reactions by market participants are to be expected and any supply and demand shocks will lead to more moderate price movements. In the case of short time periods, on the other hand, more inelastic reactions are to be expected, with the result that one-off or permanent supply and demand changes can lead to intense price reactions. Partial and general equilibrium models usually result from a long-term perspective, so that their simulations lead to fewer price effects (cf. BANSE et al., 2008).

- As already outlined, price level and price volatility and their changes are the result of a complex bundle of influential factors that can change over the course of time. As a result, the causes behind the price peak of 2007/08 do not have to correspond to the causes behind the price peak of 2010/11, at least not in their order of precedence. And future explanatory factors do not have to correspond to

past ones. Thus, the choice of observation period plays an important role for the result (cf. TROSTLE et al., 2011).

- At this point, we must determine the question as to whether the potential price influence comes about due to the mere existence of biofuels, in other words, it is purely market driven, or, above all, the consequence of expanding biofuel funding in numerous countries. Thus BABCOCK (2011) comes to the conclusion for the USA that ethanol subsidies only explain up to 5% of the price rise of wheat in the period from 2004 to 2009, while the market-driven expansion of ethanol, e.g. due to rising crude oil prices, accounts for a share of almost 30%. The almost 70% remaining can be traced back to all other factors. A political influence of only 13% at most is calculated for maize, while the pure market influence amounts to just under 50%. If this analysis is correct, which would have to be checked for other countries, above all the oil price rise would have been responsible for the price explosions and less so state biofuel subsidisation.

- However, the main reason to explain the different empirical results regarding the price influence of biofuels is, without doubt, the economic models selected for the analysis and the requisite preselection of the definitive determining factors. Thus there is so far no model that records all of the above influential factors at the same time and which maps their potential interactions in the sense of intensification and diminution. A preliminary selection therefore has to be made, which can distort the result in a definite direction. Hence a short-term, intense growth in biofuel production can cause extreme or marginal price fluctuations upwards, depending on whether stockholding activities and levels are also mapped or not, or whether the oil market is recorded as a causal factor and induced political reactions are recorded as intensifying factors within the model. The consideration or non-consideration of co-products in biofuel production as animal feedstuffs is also crucial for the price effect on agricultural commodities, as the analysis by TAHERIPOUR et al. shows (2008). When taking co-products into account, the price influence of biofuels for cereals turns out to be less than a third according to this. Often the cause and effect of the various determinants cannot be clearly told apart and thus the separate influence of an individual determinant cannot be quantified exactly.

- Finally, numerous models do not adequately map the actual price developments because they are not formulated stochastically and dynamically but are instead deterministic and comparative-static in orientation, or because they do not record the cross-price relations between the markets but are instead based on individual market analyses. In light of this literature overview and these limitations, we advise caution before branding speculation and biofuels as scapegoats for excessive and more volatile prices and hence making them responsible for greater hunger and poverty in developing countries.

3.3 INTEGRAL SIMULATION CALCULATIONS

To confirm the statement that partial equilibrium models tend to map the long-term effects and hence the price influence of biofuels ends up more moderate, the simulation model AGRISIM developed at the Institute for Agribusiness (IAB) is to be used. AGRISIM is a numerical, computer-assisted, partial equilibrium model, which works with nine different agricultural products and 16 countries or regions in the version used here. It is comparative-static in nature and works with isoelastic supply and demand functions, i.e. with constant inherent-price and cross-price elasticities. The trade between individual countries is designated as net trade (difference between supply and demand). The model is able to quantify the consequences on production, demand, net trade, producer income, consumer income, national budget and overall welfare of individual countries via the change in exogenous variables such as income, population, technological progress, yield changes, other shift factors of supply and demand as well as policy changes.

For the following simulations, the figures of the OECD/FAO (2011) cited in Chapter 2.2 for the time period 2008 to 2010 are used, i.e. that 11 % of feedgrain, 21 % of world cane sugar and 11 % of vegetable oils go into biofuel production. The demand for the relevant agricultural commodities is reduced by these percentages, and the new price equilibria are calculated. Table 1 contains the corresponding numerical values.

Table 1: Change in agricultural commodity prices in the world market, assuming a complete absence of demand for inputs for biofuel production

Agricultural commodities	Price change
Cane sugar	**-21.2 %**
Rice	**0 %**
Oilseeds	**-7.1 %**
Feedgrain	**-7.3 %**
Wheat	**-2.8 %**

Source: Integral calculation with AGRISIM

According to this, the greatest price drop occurs for cane sugar with approx. 21 %, followed by feedgrain and oilseeds with around 7 % and then far behind for wheat with just under 3 %. Nevertheless, these results have also been derived without taking into account stockholding quantities and without further political reactions. They therefore only show the long-term price influence after all market shareholders have adapted to the new situation. In the short to medium-term, there might be much greater price fluctuations if supply and demand still respond inelastically and the additional demand for agricultural commodities for biofuel production is not yet regarded as permanent, but instead as a one-off result.

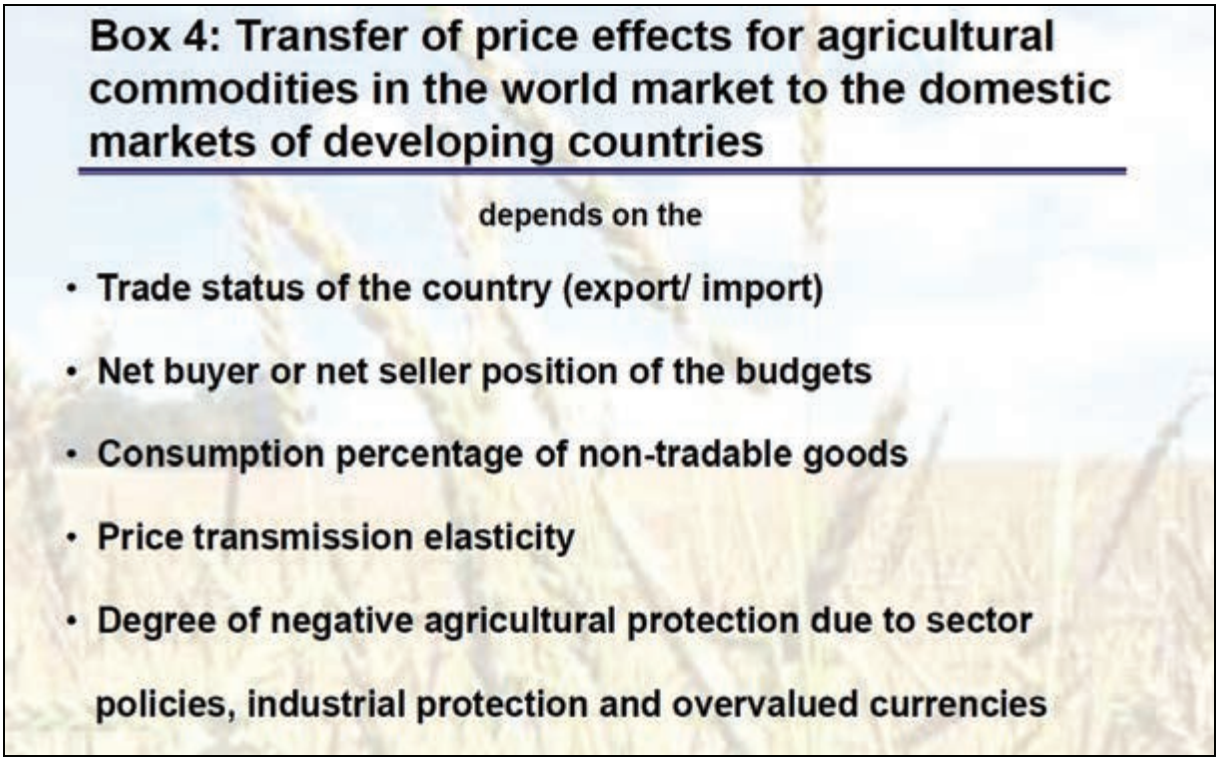
Such models are therefore less suitable for the adaptation of the prices in the timeframe. Vector autoregressive (VAR) models are used for this purpose in the literature. These are time-series analytical models of econometrics, which dispense with a-priori assumptions about causal relations and identify the time progression of variable changes as a result of system shocks (cf. KUHL, 1998; AHMED et. alia 2010). With the help of so-called impulse-response functions, the price effects of various, simultaneously-acting and mutually-dependent influential factors can be mapped better in the time progression.

4 CONSEQUENCES FOR HUNGER AND POVERTY

If we review the previous statements once again, it can be determined, looking at the situation long-term, that the level of agricultural commodity prices will only moderately be affected by the existence or funding of biofuels and is primarily the result of fundamental influential factors of supply and demand, such as energy

prices, technical progress, income and population growth. However, in the short to medium term, the weather plays a critical role, which can cause severe price reactions in interaction with low inventories and ad-hoc political responses (e.g. export restrictions and ease of importation). If, at the same time, biofuel subsidisation has also caused an actual depletion of stores over a longer period, or a politically-induced, unexpected growth impetus of biofuels occurs, a contribution towards the price explosions can, of course, also be attributed to biofuels, albeit only as part of a matrix of influential factors. The separate individual influence can hardly be estimated with the previous model approaches.

Even if we assume, however, that somewhat higher and more volatile agricultural commodity prices result in the world markets on account of biofuel subsidisation, it long remains unclear how hunger and poverty are affected in developing countries. Obviously unclear and partly incorrect ideas exist concerning the interrelation between the price situation (level and volatility) in the world market and the hunger situation in developing countries. The simple formula “high and volatile world agricultural prices are the cause of hunger and poverty" is incorrect in any case. Why? (cf. Box 4; SCHMITZ and MOLEVA, 2011).



It is first of all crucial for an individual developing country whether it is a net exporter or net importer of a product. Exporters are in a better position with higher prices and

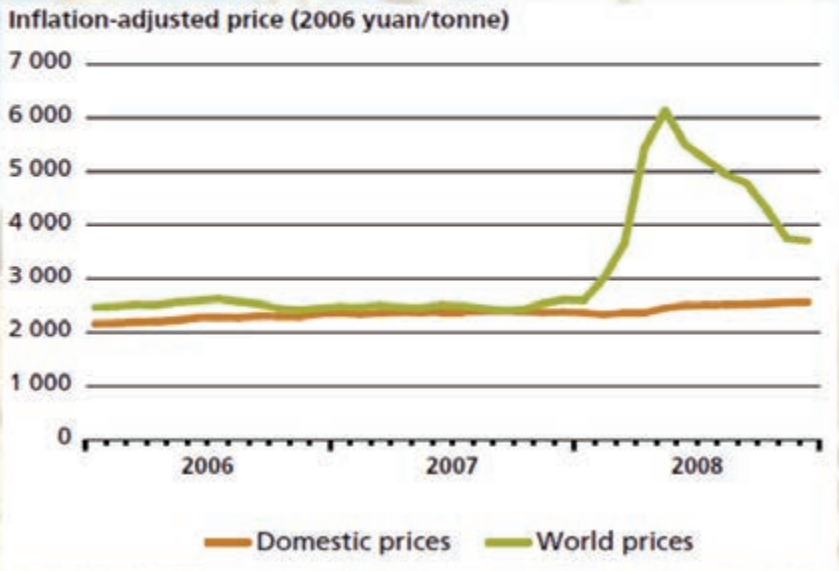
register an increase in revenue and prosperity. In contrast, importers lose prosperity at higher prices and must make more import expenses in the case of inelastic demand. If the world market prices remain more volatile at the same time, this is disadvantageous both for export and import countries, because induced income fluctuations per se have a prosperity-reducing effect or because additional costs are incurred for alleviating the risks.

Nevertheless, the effects on individual market shareholders and households are more critical than the effects for the entire country. Thus, producers basically profit from high agricultural prices, while consumers end up as losers (cf. ROBLES und TORERO, 2010). Vice versa, lower agricultural prices are an advantage for consumers and a disadvantage for producers. This includes households of producers and consumers of agricultural products at the same time, which means the net position counts. Here, urban dwellers are above all likely to be net buyers, while households in rural areas apart from landless farm labourers tend to be net sellers who benefit from high prices. Furthermore, higher agricultural prices encourage investments in agriculture and hence even contribute to an improvement in the nutritional situation long-term (cf. FAO, 2011). That is therefore significant, because 80 % of hunger and poverty prevails in rural areas.

Price level changes and price volatilities are nevertheless not passed on 1:1 to domestic prices, because governments often pursue their own trade and price policies or because high transport costs completely hinder domestic markets from accessing the world market owing to the lack of infrastructure. The price transmission elasticity (domestic price change in % due to a 1% price change in the world market) is frequently much less than one and occasionally even zero for remote rural regions in developing countries (cf. also MINOT, 2011; GILBERT, 2011 and RAPSOMANIKIS and MUGERA, 2011).

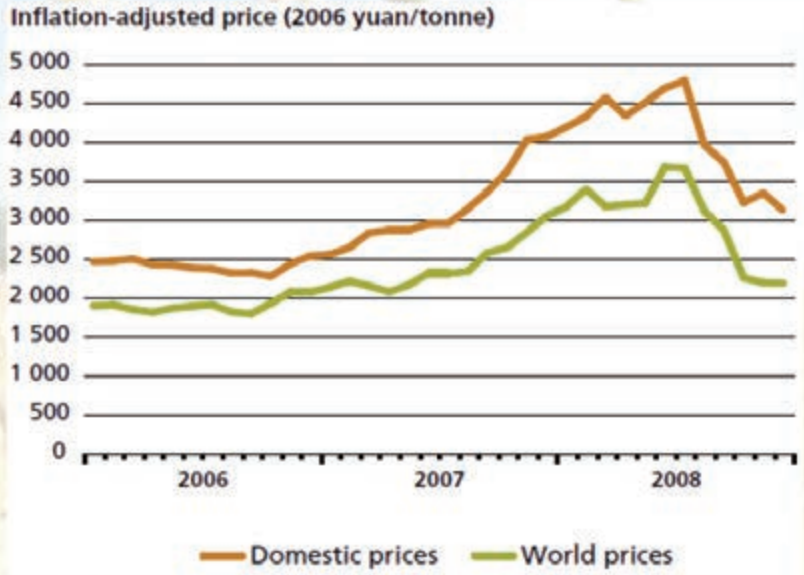
Figures 15 to 20 provide an impression of the price developments in the world market and in selected emerging and developing countries for the products rice, soya beans, maize and wheat and confirm the decoupling thesis for most products.

Fig. 15: Rice prices on the world market and in China 2006 - 2008



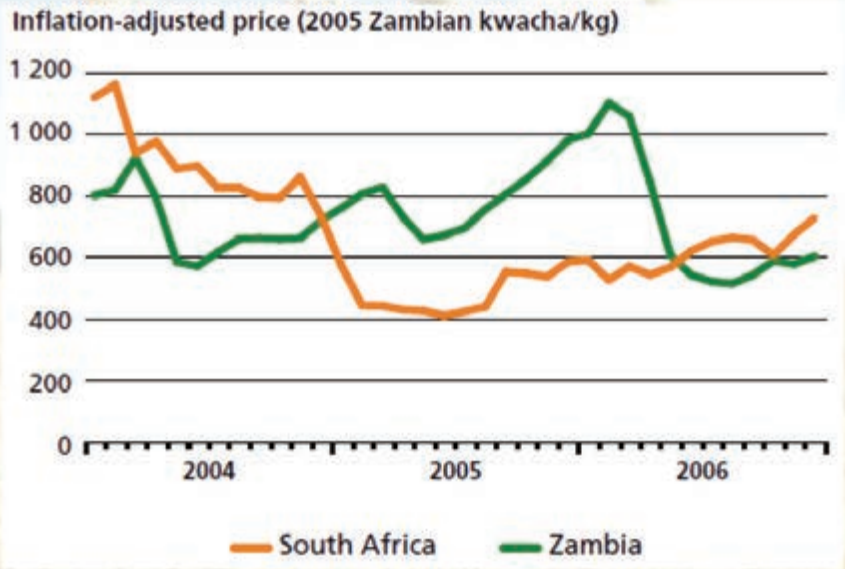
Source: FAO 2011

Fig. 16: Soybean prices on the world market and in China 2006 - 2008



Source: FAO 2011

Fig. 17: Maize prices in South Africa and Zambia 2004 - 2006

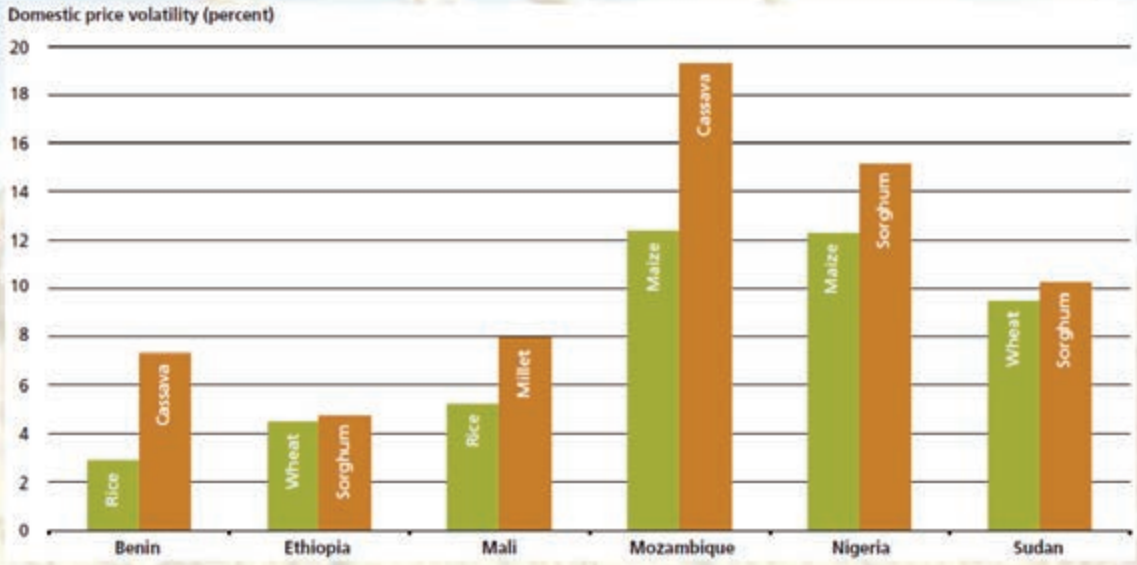


Source: FAO 2011

Fig. 18: Wheat prices on the world market and in Argentina 2007 - 2010

Source: FAO 2011

Fig. 19: Price volatilities for international and domestic products in African countries 2005 - 2010



Source: FAO 2011

Fig. 20: Price transmission elasticities for rice in select developing countries 2007 - 2008

Source: Delgado 2011

In the event that people in poor countries do not receive any nourishment from internationally tradable commodities, but instead have to rely on locally non-tradable foods, they are not affected by the processes in the world market. World market developments cannot be held responsible for hunger and poverty in these cases. In

this context, it is interesting that the prices occasionally fluctuate more significantly for local non-tradable commodities. e.g. cassava, sorghum and millet (cf. Fig. 19 taking African countries as an example). This is due to the fact that domestic production fluctuations are often more intense than fluctuations in world production on aggregate and no buffers exist as a compensation in insulated markets. An opening up to world markets and a stronger market integration would therefore even have a stabilising effect for budgets in developing countries.

Consequently, the main causes of hunger and poverty in developing countries above all lie in the developing countries themselves. Poor government, corruption, civil wars, weather extremes and not least discrimination of agriculture due to export taxes, industrial protection and overvalued currencies are to be cited here, with the result that farmers often only receive a fraction of the world market prices for their products. Hunger and poverty are therefore largely homemade and not the result of world market influences.

5 Conclusion and Implications for Policymaking

The price development of agricultural commodities is above all the result of fundamental supply and demand. Although the price-driving and price-destabilising contribution of speculation is often maintained, it is not verified empirically. On the contrary: Speculation ensures the requisite liquidity for safeguarding of the hedging business of farmers, dealers and processors, improves the price production function of commodity future markets due to the increasing number of participants and is therefore a necessary side effect of volatile markets. Biofuels are also only to be held responsible for higher and more volatile prices in conjunction with other significant influential factors. The separate influence is difficult to ascertain with the previous model approaches. And long-term, comparatively moderate effects of biofuels result on the price level and price volatility. Other factors play a much greater role there, such as the weather, income and population development, dietary habits, technical progress, the macroeconomic environment and not least the future course set by trade policies.

Even if we ascribe a limited price effect on the agricultural commodity prices in the world markets to speculation and biofuels, we cannot derive any 1:1 assignment to the domestic markets of development countries from this nor justify any causal link to

hunger and poverty. Although price rises and price volatilities can selectively intensify food uncertainty, they are not responsible for hunger and poverty, either causally or definitively. As an overriding distribution problem, we do not logically combat both by attempting to influence the level and volatility of the prices by direct state interventions. The price level should primarily reveal the shortages and not be realised into the service redistribution wishes. And price volatilities cannot in principle be excluded in the case of short-term inelastic market reactions, with only their consequences being able to be cushioned. Long-term, open borders, free trade and greater market transparency, in particular, contribute to a stabilisation of the agricultural commodity prices (cf. FAO et al., 2011). This also applies to developing countries and should be within the framework of a south-south trade, i.e. an exchange of neighbouring countries or regions.

Hunger and poverty, on the other hand, are almost exclusively homemade problems in developing countries due to poor government, corruption, civil wars and discrimination of agriculture and/or on account of weather extremes such as the drought in Somalia. They are best combatted by investments in agricultural products and the market infrastructure as well as by establishing a social safety network for the very poorest.

In particular, agriculture would be freed of its burdens under trade, agricultural and currency policies, so as to initiate corresponding production impetuses and lift smallholders from subsistence and integrate them into the local markets. The contribution by industrialised countries could involve opening their markets to exporting developing countries more than previously, dispensing with their own trade-distorting export subsidies and hence generating a greater price-stabilizing buffer volume for market shocks at the same time.

Finally, it can be determined that biofuels and their subsidisation cannot be held responsible for hunger and poverty in the world. Even their influence on pricing in the world market is limited or only significant short-term in conjunction with other driving factors. Nonetheless, the image of the biofuel industry could be significantly improved if its state funding was designed to be closer to the market in future and would not degenerate into a permanent state of subsidisation. At the same time, technological progress and learning curves could help to grant freedom from state support and hence frequently associated overregulation, and it would surely also be advisable to specify the positive external effects brought by the sector into the discussions more

precisely and quantify these with suitable methods. Only then can an honest cost-benefit balance be concluded for the funding of biofuels and an objectification of the currently heated debate be achieved.

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