Shocks in economic growth = shocking effects on agricultural markets?

A. KAVALLARI, T. FELLMANN and S. H. GAY
European Commission, Joint Research Centre, Institute for Prospective Technological Studies
Edificio Expo, c/Inca Garcilaso 3, 41092 Seville, Spain, tel: +34954488342, fax: +34954488434, aikaterini.kavallari@ec.europa.eu

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Abstract

Projections on the development of agricultural commodity markets underlie a given set of assumptions on economic growth. However, recent economic and financial crisis, as well as signs of quicker recovery in emerging economies, increase uncertainty in the forecasts of macroeconomic developments. This paper analyses the effects of different economic growth scenarios on agricultural commodity markets. In particular we assess the potential impacts of a faster economic growth in emerging economies on the one hand and of a replication of the recent economic downturn on the other hand. The empirical analysis uses the AGLINK-COSIMO model and builds upon the recently published European agricultural outlook of the EU Commission. The simulation results demonstrate that higher economic growth influences demand more than supply, resulting in higher world market prices. Emerging economies tend to import more and stock less in order to cover their demand needs, while the rest of the world increases its exports. In total the ending stocks decrease and combined with the increased consumption, the stock-to-use ratio decreases. Replication of an economic downturn affects the markets differently, depending on how elastic or inelastic the markets react to price signals. Livestock markets appear more stable and do not regain their baseline levels within a 5-year period. The magnitude of the effects is smaller the longer the simulated time path is and certainly depends on the introduced shock.

Keywords: economic growth, agricultural commodity markets, AGLINK-COSIMO

1. Introduction

Turbulences in the global financial system and the general economic downturn made "economic crisis" a term that started to enter everyday vocabulary. The recent financial and economic crisis hit developing countries as well as developed ones. While many countries started to show recovery signs, the recent Greek crisis and mostly the rapid spreading of contagion fears to other European countries facing budget deficit problems not only slows but also threatens global economic recovery. This also clearly shows that nowadays local problems, even in small countries, can become very quickly global ones, making it even more difficult to conduct forecasts regarding the development of economic growth.

Economic growth in commodity market outlooks is usually assumed to follow a stable path in the medium-term. Worldwide economic recovery started in 2010 but the long term real GDP growth is expected to return to its pre-recession levels only after 2011 (Global Insight, 2010).The World Bank (2011) estimates that real GDP expanded by 3.9% in 2010 and expects the positive growth to continue. It identifies as driving factor the strong domestic demand in developing countries. FAPRI (2011) assumes a real GDP growth of 3.3% in 2019, while the agricultural outlook of OECD and FAO (2010) is set on a two speed economic recovery and assumes that developing countries show quicker recovery signs than developed ones. Finally the recently released European agricultural outlook (DG AGRI, 2010) assumes growth rates of the GDP index of 3% for developed and of more than 6% for emerging-developing economies.

Expectations on economic growth are subject to uncertainties and at the moment changes in the economic environment are more likely to take place. Experts point out in the above mentioned outlook exercises that growth in emerging economies may regain quicker the trend towards rates observed in the pre-crisis period. At the same time concern is expressed that another recession may take place, for example due to excessive national debts, affecting not only the finances of the respective countries but also the price level projections of commodity markets.

The overall economic condition and economic growth are reflected in the demand for commodities and in input prices and thus entail rather strong implications for developments on agricultural commodity markets. Under ceteris paribus and in a static framework, one could expect that higher economic growth would result in increased consumption and hence higher prices. This would then in a dynamic framework trigger a response on the supply side, which could in turn drive the prices downwards. In an analogous way the reverse effects could be expected in the event of a downwards economic shock. Moreover it is not only the level of economic growth but also the path and pace that it follows which affect commodity balances and hence food availability.

However, there is still little consensus on whether the effects of economic growth on food consumption can outweigh its impacts on production costs and there is hardly any empirical evidence on the magnitude of these effects. This concern is well understood by policy makers and market experts and makes discussions on the vulnerability of the global food system particularly relevant (see for example Baffes and Haniotis, 2010; FAO, 2010; Braun, 2008).

Against this background this paper analyses how shocks in the economic growth of major economies can affect the developments on agricultural commodity markets. In particular we want to address the following questions: What are the impacts of a faster economic growth of emerging economies on agricultural commodity markets worldwide? What are the impacts of a repetition of the economic crisis on the agricultural sector and how long does it take for the agricultural markets to regain their pre-distortion equilibrium? In order to answer these questions we use the dynamic, partial equilibrium model AGLINK-COSIMO to simulate different scenarios on exogenously assumed economic growth paths over the next ten years. Building on the recently published agricultural outlook of the EU Commission (DG AGRI, 2010), we simulate one faster economic growth scenario and assess if indeed the demand reactions are bigger than the supply ones and if yes how much higher the agricultural prices are going to be. In a second scenario we repeat the recent economic crisis of 2008-2009 with regard to decreases in GDP growth rates and assess how prices develop, what the effects on commodity balances are and how long it takes for agricultural markets to return to their initial equilibrium.

The remaining of the paper is organised as follows. Section 2 describes the AGLINK-COSIMO model and the underlying assumptions of the simulated scenarios. Section 3 reports the results with regard to changes in commodity balances and in market prices. Section 4 concludes.

2. The model and the simulation scenarios

AGLINK-COSIMO is a global recursive-dynamic, partial equilibrium, supply-demand model covering the main agricultural products (see OECD, 2006). AGLINK has been developed by the OECD Secretariat[1] in close co-operation with OECD member countries and, thanks to its

[1] The results of any analysis based on the use of the AGLINK-COSIMO model by parties outside the OECD are outside the responsibility of the OECD Secretariat. Conclusions derived by third-party users of AGLINK-COSIMO should not be attributed to the OECD or its member governments.

linkage with FAO's COSIMO model, it incorporates the major non-OECD member countries and other regions of the world. The version of the model used for this paper identifies in total 52 countries or regions and covers all major temperate zone agricultural commodities as well as rice and vegetable oils. Sugar and sweeteners are fully integrated into the model, while biofuels (ethanol and biodiesel) are modelled in detail only for the USA, the EU, Brazil and Canada[2]. Bilateral trade flows between countries or regions are not modelled. Instead the commodities are considered as homogenous but because prices are cleared domestically and because standard trade functions are used to model trade policies, the model represents separately imports and exports.

In this paper the baseline projection (scenario 0) assumes continuation of existing policy measures for the period 2010-2020. Macroeconomic assumptions on economic growth and exchange rate developments are taken from Global Insight (2010). Economic recovery is expected to begin from 2010 onwards and is lead by Asian countries that are projected to have the highest annual GDP growth. Table 1 summarises the assumed real GDP growth rates in the baseline for emerging markets as well as the USA and the EU.

Table 1: Baseline assumptions of real GDP growth from previous year, in %

	2009	2010	2012	2015	2020
Brazil	0.1	3.6	3.2	3.1	2.8
Russia	-8.7	3.2	5.6	5.3	4.6
India	6.0	7.5	6.9	6.8	5.4
China	8.4	8.7	9.0	8.1	6.2
Argentina	0.9	0.2	3.3	3.9	3.7
Mexico	-8.0	2.7	4.0	4.1	3.0
Indonesia	4.3	5.4	4.8	4.6	4.0
Malaysia	-2.3	4.1	4.5	4.2	3.7
Thailand	-2.7	3.5	3.8	3.6	3.2
USA	-2.5	2.5	2.8	2.7	2.3
EU-15	-4.2	1.7	1.7	2.2	1.8
EU-12	-3.5	2.0	4.1	4.3	3.6

Source: Global Insight (2010)

Further exogenous developments for the EU markets are set out in DG AGRI (2010), while for the rest of the countries/regions they are taken over from OECD and FAO (2010). It is assumed that the world price for crude oil will increase over the simulation period from USD 72.8 per barrel in 2009 to USD 98.0 in 2020.

Two scenarios have been developed assuming different economic growth paths for the countries listed in Table 1. These countries are selected because they are the main agricultural commodity price makers and in these countries the historical changes in GDP growth have been the highest. Furthermore, as they already show signals of strong domestic demand, the likelihood is higher that their economic growth may increase faster than assumed in scenario 0.

Scenario 1 assumes faster economic growth compared to scenario 0. In order to be able to introduce correlated adjustments of exchange rate developments the scenario uses historical

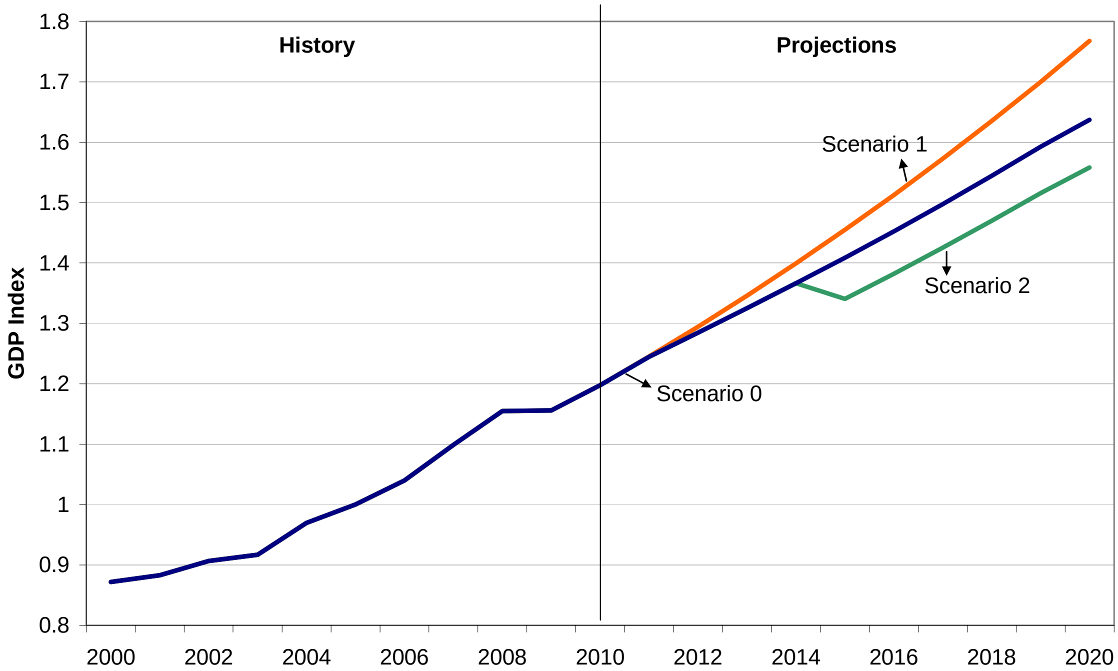
[2] OECD (2008) gives more details on the modelling of biofuels in AGLINK-COSIMO, while Blanco Fonseca et al. (2010) give details on the modelling and on the market impacts of EU biofuel policies.

annual GDP growth rates. The year 2006, has been selected because it was characterised by high global economic growth.

Scenario 2 introduces a shock in economic growth in 2015. It simulates the recent economic downturn by repeating the 2008-2009 decrease of GDP growth and it takes into account the correlated effects on exchange rates. The simulations involve again the countries of Table 1. Regarding crude oil prices, the shock repeats the absolute difference in the world crude oil prices between 2008 and 2009.

Figure 1 illustrates the assumptions of all three scenarios exemplified on the Brazilian GDP index. An analogous pattern is followed for the rest of the countries under consideration (cf. Table 1).

Figure 1: Brazilian GDP index assumptions



Note: Base year = 2005
Source: Model assumptions

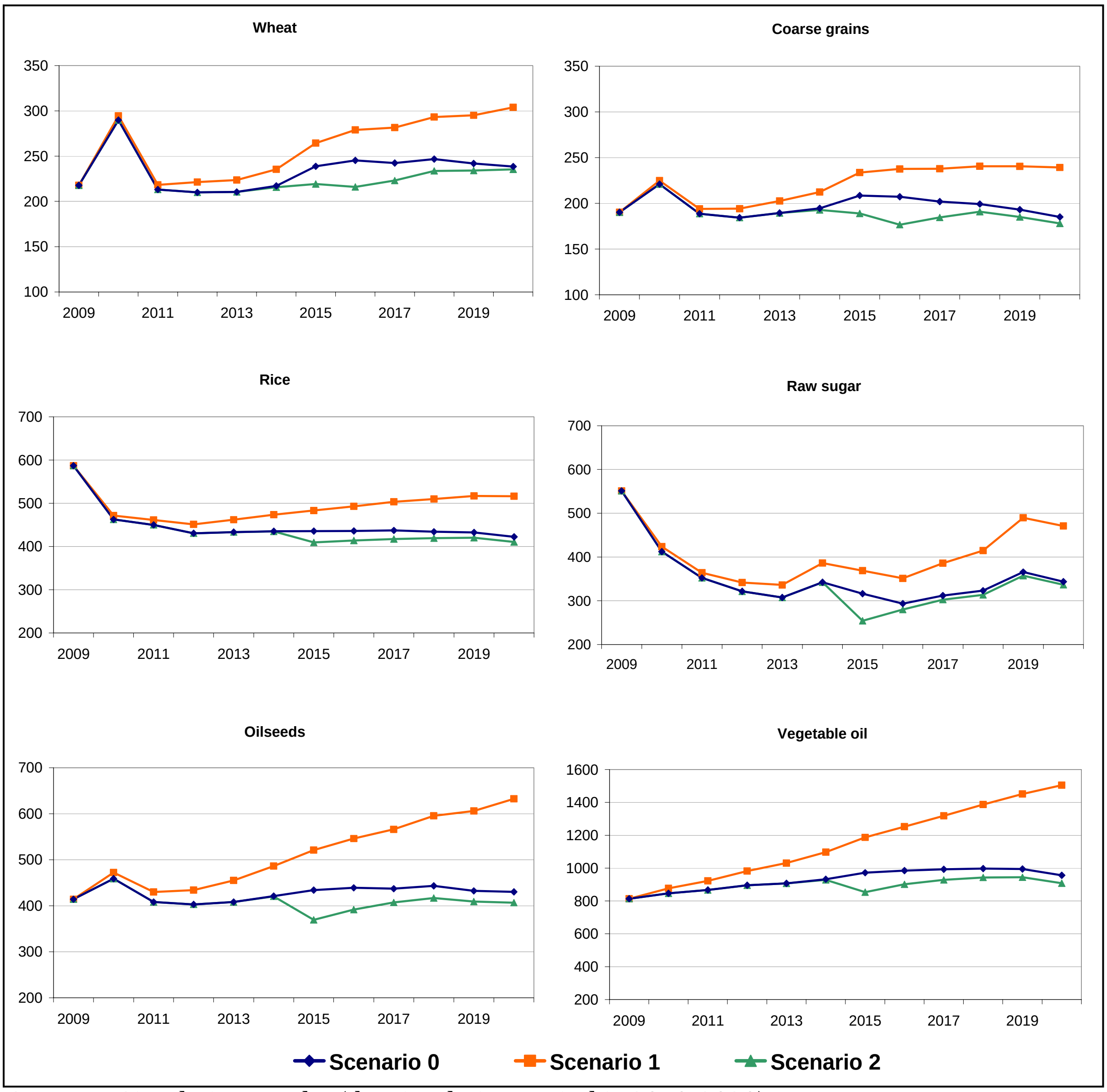
3. Simulation results

Figures 2 and 3 depict the effects in world market prices for crop and livestock commodities respectively.

The results of scenario 1 show that higher economic growth in emerging economies, the EU and the USA can indeed alter the picture of agricultural markets and can lead to a higher price level. In this scenario the simulated faster economic growth stimulates demand and the increase in consumption is higher than production can respond. At the end of the simulation period the cereals prices are almost 30% higher than the prices in scenario 0, and the increase is even higher for oilseeds (+47%) and vegetable oil (+57%). The developments in livestock and dairy markets follow a similar path, with the effects being stronger for meat. Beef and veal prices increase by 32%, while pork prices increase by 43%. Prices for butter are projected to increase by 20% and for SMP by 14%. The magnitude of the change depends on the importance of each country on the world market of a particular commodity.

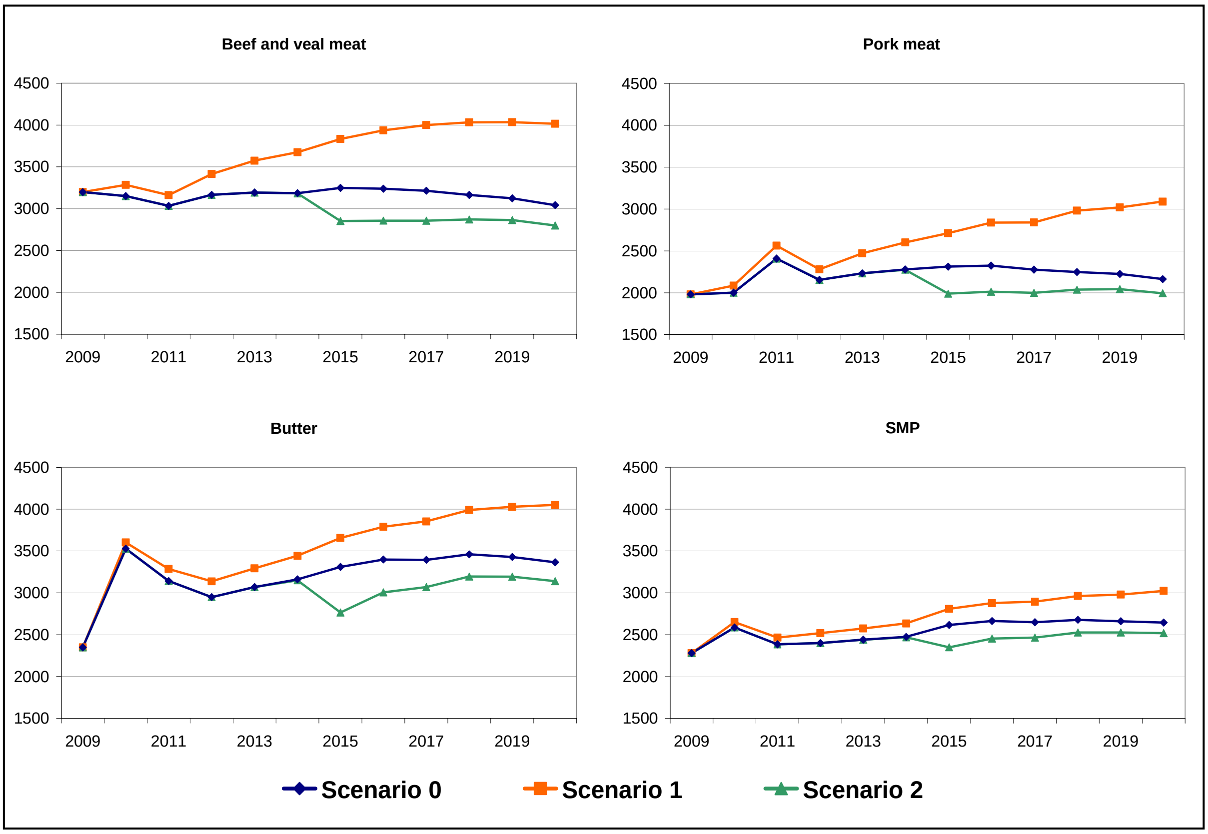
In scenario 2, the shock on economic growth in emerging countries and the reduction of crude oil prices affect negatively the demand in the year the shock was introduced (i.e. year 2015), which in turn results in lower world market prices. The supply response is seen in the next year (2016) but the effects are different among the markets. Cereals are projected to be more affected, which is not only because cereal markets are more reactive to price developments but also because the simulated shock involved countries that are price makers. Furthermore, the shock in crude oil price affects the biofuel markets and hence the feedstocks (i.e. the shock induces a temporary reduction of biofuel consumption, followed by a temporary reduction of feedstock demand for biofuel use). From 2017 onwards the markets start returning to their pre-shock levels, with cereals again being more reactive. By 2020 crops have regained the baseline price levels, while world market prices of the oilseed block and livestock commodities are still by about 0.05% and 0.08% lower than in scenario 0.

Figure 2: Development of world market prices for crop commodities (in $US per tonne)



Source: Simulation results (the simulation period is 2010-2020)

Figure 3: Development of world market prices for livestock commodities (in $US per tonne)



Source: Simulation results (the simulation period is 2010-2020)

Table 2 and 3 summarise the effects in the commodity balances of Brazil, Russia, India and China (BRICs), the EU, the USA and worldwide. The effects in other emerging Asian economies follow a similar path as in India, while the effects in other Latin American countries are comparable to the effects projected for Brazil.

Looking at the world markets, faster economic growth as simulated in Scenario 1 results in higher consumption and domestic production, but the effects in supply do not outweigh those in demand. The ending stocks decrease and this combined with the higher consumption leads to lower stock-to-use ratios worldwide. The increase of imports almost equals the increase of exports.

The picture is different in individual countries. In the BRICs, the increased consumption is met generally by higher imports and lower stocks. Exports decrease and domestic production increases slightly only in India and in China. On the other hand, the EU and the USA boost their exporting capacities. This is particularly evident for oilseeds, where both the EU and the USA produce more and consume less, being thus the leading crushers worldwide and exporting both oilseeds and the crushed products, namely vegetable oil and oilmeals. Hence redistribution of trade and difference in stocking activities are the main factors that clear domestic markets.

Table 2: Effects on commodity balances in 2020, Scenario 1 vs. Scenario 0 (in %)

	World	EU	USA	Brazil	Russia	India	China
			Production				
Wheat	2.4	4.7	3.8	-38.3	-4.0	3.9	2.0
Coarse grains	2.5	1.7	2.4	-0.6	-0.9	5.8	3.7
Oilseeds	2.7	4.5	10.2	-22.8	1.3	6.1	3.8
Vegetable oil	-1.8	-3.3	-3.9	-6.1	2.3	5.9	-1.9
Beef meat	3.5	3.7	0.9	-14.8	2.2	15.1	17.2
Butter	2.8	3.3	4.1	5.4	4.9	3.1	13.1
			Consumption				
Wheat	2.6	4.7	2.4	3.1	5.3	8.4	1.8
Coarse grains	2.6	5.6	0.6	6.0	1.6	7.2	3.8
Oilseeds	2.7	-3.5	-4.9	-5.4	2.1	6.1	-1.5
Vegetable oil	-1.0	-13.7	-20.7	-0.1	4.3	12.8	10.1
Beef meat	3.5	2.7	0.0	5.2	5.8	17.5	17.2
Butter	2.8	0.7	3.9	3.8	8.8	3.1	11.2
			Ending stocks				
Wheat	-5.3	-0.6	-0.5	n.a.	0.0	-19.3	2.0
Coarse grains	-1.7	-0.4	-9.9	14.2	0.0	-37.4	3.7
Oilseeds	-3.8	0.5	-14.7	-3.9	0.0	-0.6	-0.1
Vegetable oil	-0.3	-0.8	-3.8	0.0	0.0	1.9	0.0
Beef meat	-0.1	-0.2	0.0	0.0	0.0	15.4	0.0
			Imports				
Wheat	1.7	-4.3	0.0	20.6	34.0	49.2	-4.1
Coarse grains	2.0	95.6	0.0	34.0	51.0	3.8	21.3
Oilseeds	-7.6	-16.0	0.0	0.0	5.2	-1.2	-7.5
Vegetable oil	-0.9	-28.6	0.0	0.0	1.1	17.4	23.2
Beef meat	-4.4	-5.3	3.2	0.0	38.4	-0.1	0.0
Butter	11.7	-18.0	0.0	-22.1	17.2	9.9	0.0
			Exports				
Wheat	1.7	2.9	5.9	0.0	-25.4	-2.1	0.0
Coarse grains	1.9	1.4	13.9	-25.3	-33.8	-60.2	-3.1
Oilseeds	-7.3	70.7	31.9	-43.5	-4.9	2.4	0.0
Vegetable oil	-0.9	79.7	242.4	-22.5	-1.1	-1.4	0.0
Beef meat	-4.0	15.2	15.1	-80.6	0.0	6.6	0.0
Butter	12.4	59.9	6.0	28.3	0.0	-9.2	0.0

Note: n.a.: non available
Source: simulation results

The effects of scenario 2 show that an economic downturn only in emerging economies, the EU and the USA is enough to result in decreased consumption worldwide, followed by decreased domestic production. Re-distribution of trade and short-term changes in stocks are the main market forces that lead to stabilisation of the markets and a return to pre-shock market levels (Table 3).

However, the effects are different among countries and markets. By 2020 in the EU, Brazil and Russia exports generally increase, with the effects being higher for cereals and beef meat in the EU, cereals in Russia and livestock commodities in Brazil. Exceptions to this development are beef meat in the EU (decrease of exports by 1.2%) and butter in Brazil (decrease of exports by 18.5%). Looking at imports, they generally decrease only in the EU (apart from coarse grain imports) and in Russia. It is worth noting that in China, although consumption decreases, there are hardly any changes in exports, and only imports of cereals and vegetable oil decrease (by 5.4% for wheat and 3.6% for each of coarse grains and vegetable oil). Furthermore, only in India the shock in economic growth does not involve reduction of consumption by 2020, implying an inelastic consumption of agricultural commodities in India. This coincides with findings of Kumar et al. (2010) and in turn implies that world market developments in India affect more trade and stocks rather than domestic production and consumption. The inelastic Indian consumption is followed by decreased domestic production, higher ending stocks and imports and reduced exports.

Table 3: Effects on commodity balances in 2020, Scenario 2 vs. Scenario 0 (in %)

	World	**EU**	**USA**	**Brazil**	**Russia**	**India**	**China**
			Production				
Wheat	0.2	1.1	-0.8	19.4	1.5	-0.5	-0.3
Coarse grains	-0.4	-0.1	-0.5	-1.1	0.2	-0.4	-0.3
Oilseeds	0.0	0.7	-1.7	6.9	1.7	-1.4	-0.6
Vegetable oil	-0.4	0.3	-0.5	0.3	0.5	-1.9	-0.1
Beef meat	-0.9	1.1	-2.1	2.6	-2.3	-5.2	-2.3
Butter	0.2	-0.1	-0.4	-2.0	-1.6	0.8	-0.5
			Consumption				
Wheat	-0.8	-1.0	-2.2	-2.7	-3.8	0.0	-0.4
Coarse grains	-0.6	-0.2	-0.9	-2.8	-0.4	0.0	-0.3
Oilseeds	-0.1	0.0	-0.3	0.3	0.5	-1.4	-0.2
Vegetable oil	-0.5	0.5	0.0	-1.2	-3.4	0.4	-1.8
Beef meat	-0.9	-0.5	-1.2	-2.4	-2.8	2.2	-2.3
Butter	0.1	-0.5	-0.4	-0.8	-4.3	0.8	-0.4
			Ending stocks				
Wheat	3.7	-0.6	-3.1	n.a	0.0	3.0	-0.3
Coarse grains	-1.2	-0.1	-2.1	-5.0	0.0	3.7	-0.3
Oilseeds	-0.5	0.0	-1.5	0.2	0.0	-1.9	-0.2
Vegetable oil	-0.7	-0.2	-0.4	0.0	0.0	-0.3	0.0
Beef meat	-0.4	-0.7	0.0	0.0	0.0	0.4	0.0
			Imports				
Wheat	3.5	-11.4	0.0	61.5	-12.2	2.5	-5.4
Coarse grains	1.7	12.9	0.0	-4.9	-9.3	1.0	-3.6
Oilseeds	0.2	-1.0	0.0	0.0	-9.2	0.8	0.4
Vegetable oil	-0.2	0.5	0.0	0.0	-3.8	2.2	-3.6
Beef meat	0.1	-17.9	-1.6	0.0	-8.1	0.8	0.0
Butter	-2.6	-2.0	0.0	22.6	-10.3	1.0	0.0
			Exports				
Wheat	3.4	13.7	0.5	0.0	13.9	-0.1	0.0
Coarse grains	1.7	19.2	1.2	5.1	10.2	-21.3	0.2
Oilseeds	0.2	4.7	-4.0	14.7	10.1	-1.6	0.0
Vegetable oil	-0.2	0.1	-5.1	4.6	3.9	-0.2	0.0
Beef meat	0.1	-1.2	-11.5	19.0	0.0	-30.7	0.0
Butter	-2.7	8.1	-0.8	-18.5	0.0	-1.1	0.0

Note: n.a.: non available
Source: simulation results

4. Concluding remarks

In recent commodity market outlook exercises it is usually assumed that there will be a smooth and steady path of recovery out of the recent economic crisis. However, there is increased uncertainty that such a smooth recovery will really occur. This paper assesses how shocks in economic growth would impact the developments on agricultural commodity markets in the period 2010-2020. In one scenario it is analysed how higher economic growth in emerging markets, the EU and the USA affects agricultural markets. In a second scenario it is assessed how an identical economic downturn as experienced during 2008 and 2009 in the same set of countries would alter the initially projected developments on agricultural commodity markets. The analysis uses the partial equilibrium recursive dynamic model AGLINK-COSIMO.

Faster economic growth only in emerging markets, the EU and the USA as simulated under scenario 1 results in higher consumption, which drives the world market prices for all agricultural commodities upwards. The higher prices trigger an increase in worldwide production. However, the production increase is not as high as the consumption increase and hence world market prices remain high. Individual countries meet their internal needs mainly by selling or buying stocks and by importing or exporting more.

The introduction of a downwards economic shock as in scenario 2 results in lower consumption in the year of the shock, followed by reduced production in the next year. Cereal markets react more elastic to price responses than processed food markets and livestock commodities. This leads on the one side to relatively higher reductions of the cereals world market prices but on the other side also to a quicker return of the markets to their initial (baseline) levels. The results demonstrate that it takes more than five years for the markets to recover and absorb the demand shock.

The simulations show that there is no homogenous reaction to economic shocks among individual countries. The changes in domestic production and consumption are limited while changes in imports, exports and ending stocks are more visible. These developments would be higher if the simulations on economic growth would cover more countries.

Returning to the question of the title of the paper, the results demonstrate that shocks in economic growth indeed affect agricultural markets. The precise magnitude of the effects, and thus the answer to the question if the effects turn out to be really ‘shocking’, clearly depends on the magnitude of the introduced economic shock. Nonetheless, clear trends can be observed: domestic production alone cannot cancel the effects of increased demand and markets tend to return to their initial levels in the medium-term unless further distortions take place. However, in the light of ongoing discussions on food vulnerability, the findings of the paper leave scepticism on whether all countries, and in particular developing ones, have the capacity to cope with the changes on agricultural markets induced by economic shocks.

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