

Trends and development in smart farming: On path towards autonomous agriculture

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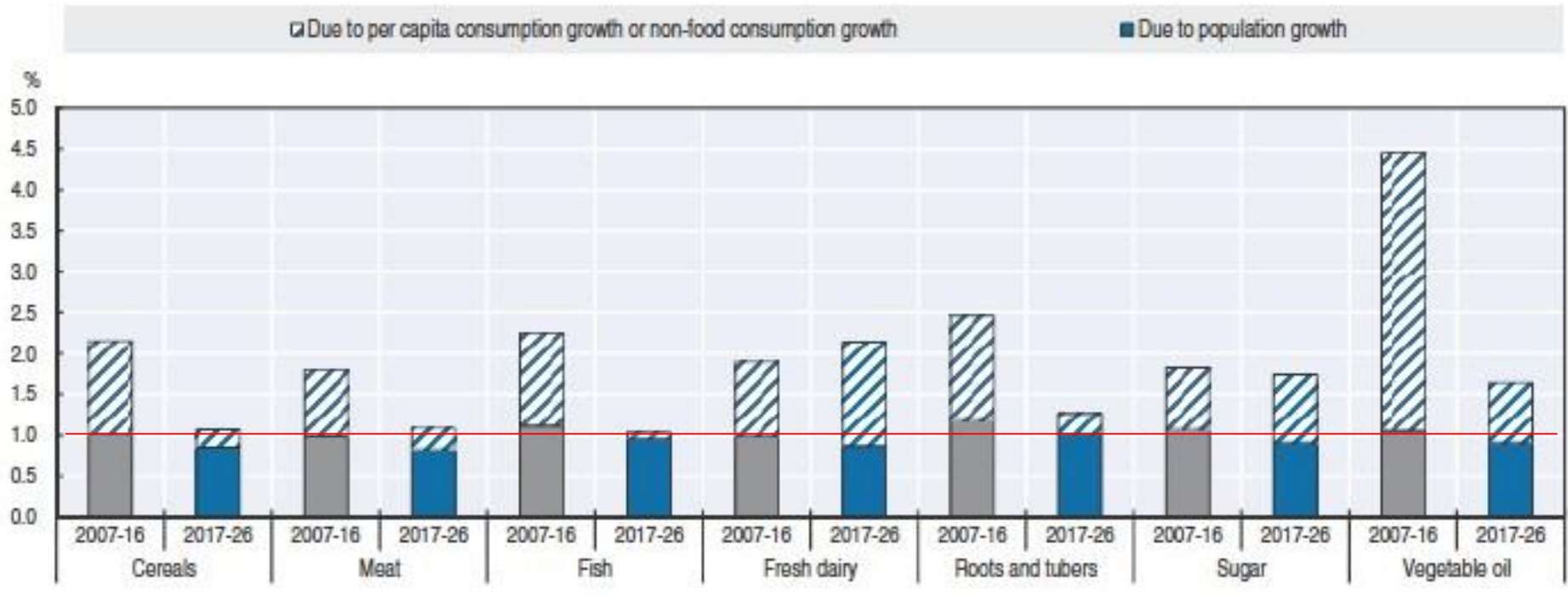


Leading Farmers CZ

- Established in 2000, majority owned by private Norwegian investors
- Major product lines
 - *Distribution of smart farming technologies (GPS autosteer, section control, VRA, sensors) and farm electronics*
 - *System integration in precision farming area*
 - *Farm advisory, data processing*
 - *Internet platform for farm advisory, trading, communication and information www.leadingfarmers.cz*
- Main sales territory is the Czech Republic and Slovakia with certain export activities to various European countries
- Since 2015 operations in Slovakia are carried out by sister company - Leading Farmers SK
- 16 employees in both countries combined, certain activities outsourced

Food consumption

Saturation of per capita consumption. Further food consumption growth will be driven mainly by world population growth (1 % per year), not by increased per capita consumption - especially in cereals, meat and fish.



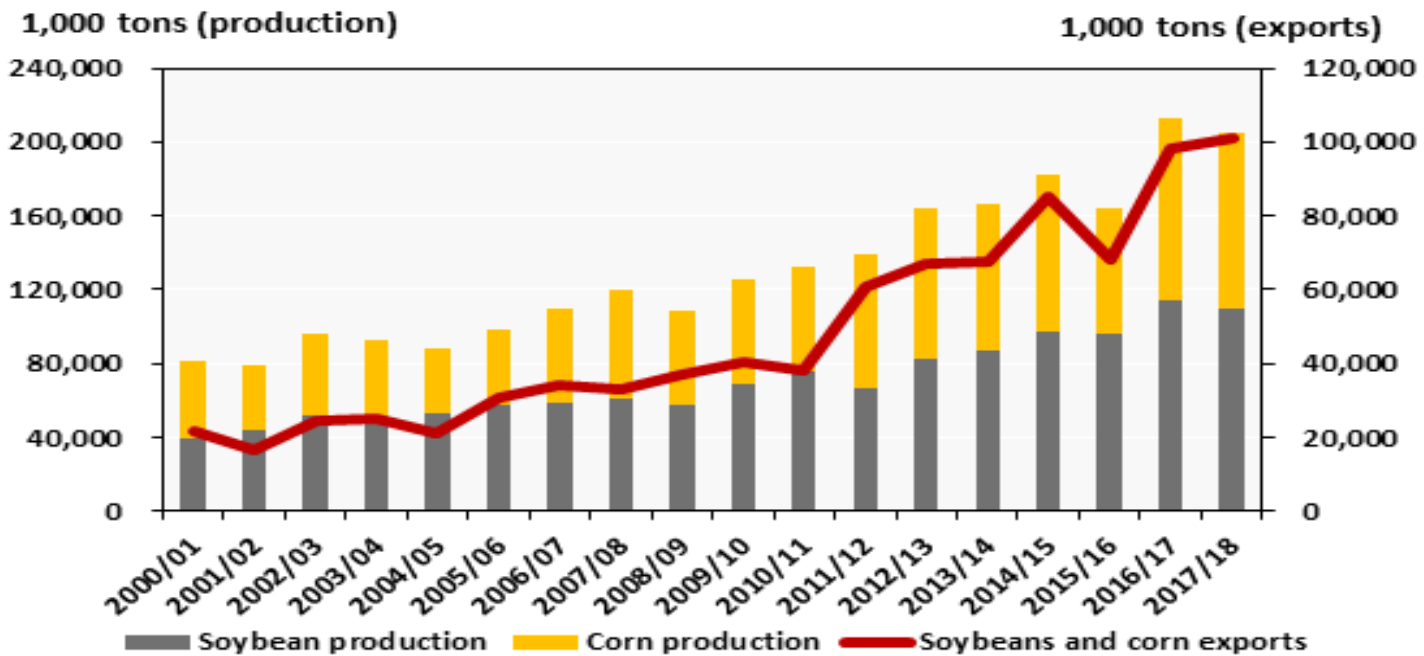
Source: Koen Deconinck, Hubertus Gay and Holger Matthey

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Food production

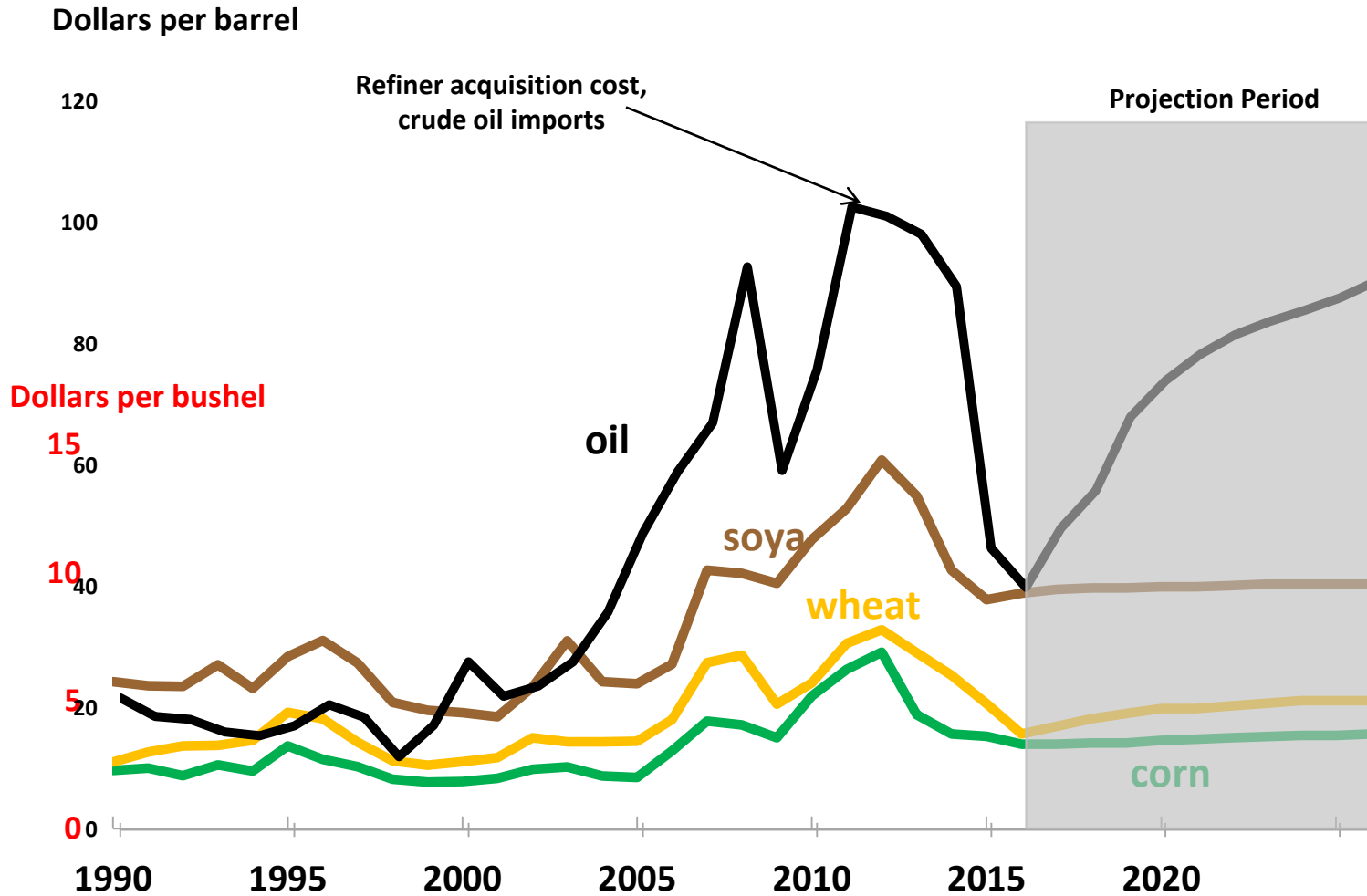
World food production growth keeps pace with food consumption growth. Growers from South America (Brazil and Argentina) were able to increase their production substantially in previous two decades.



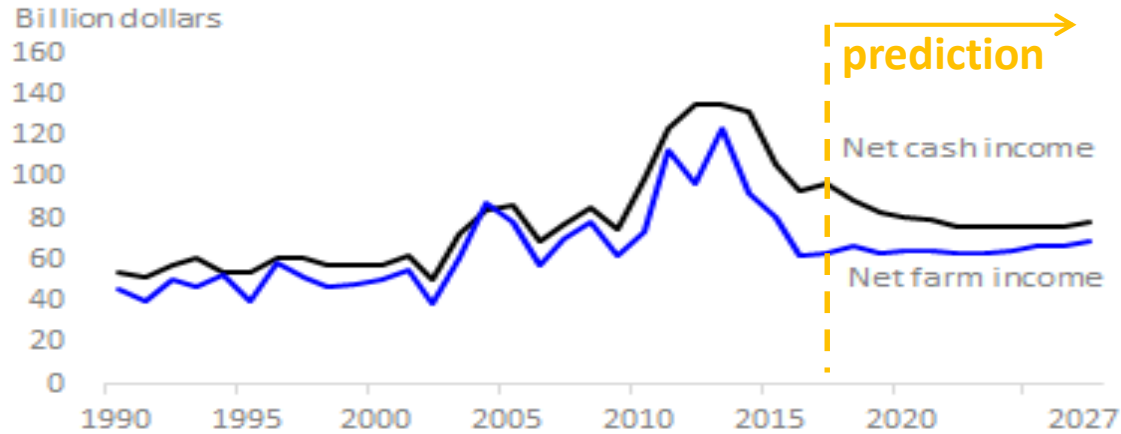
Source: USDA, Economic Research Service using data from FAS PS&D and FAS Brasilia GAIN Reports.

Brazil

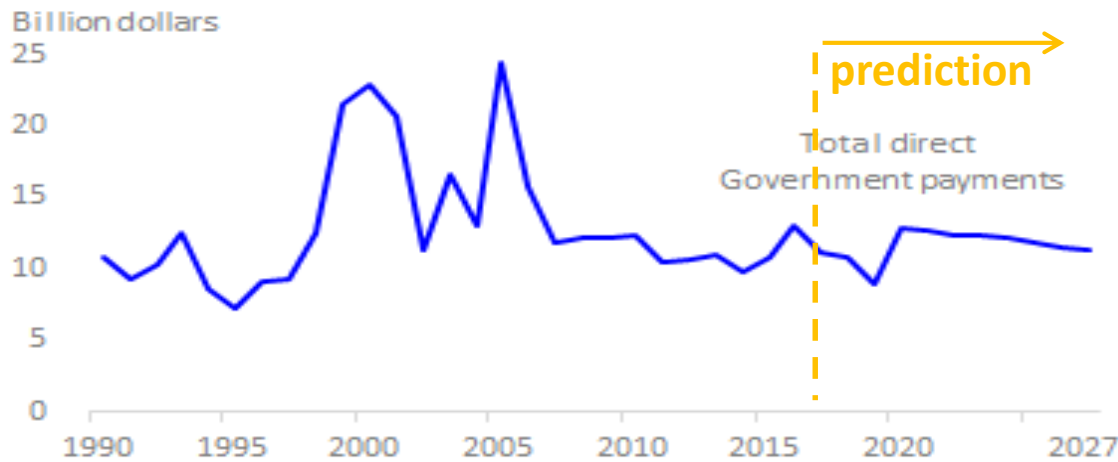
USA agri commodities prices: corn, soya and wheat vs. crude oil



Farm income



US farms
income
indicators



US government
direct farm
subsidies

Source: USDA

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Other driving factors

- Environmental awareness
 - pesticide residues
 - nutrients losses to water
 - heavy metals
 - antibiotics
 - stricter limits on engines emissions
- Soil compaction
- Erosion
- Drought
 - irrigation water resources
 - precipitation surface runoff
 - desertification
- Weather extremes
- Labour force scarcity
- Farm subsidies reduction
- Fast expanding production in South America

Conclusion: Farms should be more efficient

- New, better varieties of crops
 - Breakthrough genetics (CRISPR) - new traits in fraction of time needed in the past
- Eliminating soil compaction
 - Controlled Traffic Farming, small, lightweight swarms of field robots
- Soil erosion prevention
 - cover crops, no-till, crop rotation, optimised swath direction and fields shape and size
- Increasing organic matter content in soils
 - cover crops, reduced tillage
- Nutrients losses elimination
 - sensors, IoT, big data, efficient variable rate/spot application of inputs
- Limited use of pesticides
 - intelligent mechanical weed control, sensors, image recognition
- Proper timing of all operations
 - autonomous machinery, advanced logistics
- Reduced operation costs
 - autonomous machines, change in assets ownership, advanced contracting, electric/diesel electric power trains, telemetry, big data
- Better storage of farm products

Meet farm autonomous vehicles and robots

- Animal husbandry ahead of field production in introduction of robots
 - Milking, feeding, cleaning and forage pushing robots have been around since 20 years ago
- Field production - probably 3 ways of development
 - autonomous tractors
 - rebuilt from existing tractors through an autonomous retrofit kit
 - built as autonomous, no cabine
 - built as autonomous with cabin and optional manual steering kept
 - autonomous field vehicles
 - lightweight small vehicles built as implement carrier with developed autonomous fleet skills, working often in swarms of robots, electric power train
 - specialised robots
 - fruit harvesting, pruning

Here they are coming

- Videos
- [CNH](#)
- [ATC](#)
- [Robotti](#)
- [Ecorobotix](#)
- [Octinion](#)

Advantages and challenges of autonomous systems adoption - farms

- ✓ Fully controlled predefined trajectory of farm vehicles with high accuracy
 - ✓ 24/7 operations
 - ✓ Elimination of human errors
 - ✓ Solution to labour force shortage
 - ✓ Cost savings - labour, fuel, cost of ownership
 - ✓ Opportunity to speed up electric power train adoption
 - ✓ Some of them lightweight, eliminating soil degradation
 - ✓ Farm innovators ready to adopt the technology
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- Safety features
 - Legal constraints
 - Logistics
 - Theft danger

What the advent of autonomous systems means for ag machinery distributors and importers

- ✓ New business opportunities
 - ✓ Expansion of traditional product lines
 - ✓ Machine as a service business concept
 - ✓ Image of State-of-the-Art technology pioneers
 - ✓ Partial or complete elimination of machine operator as a middle-factor influencing machine performance
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- More complex business environment
 - Some of the decisions will require extra courage as they will have to be done in legally grey zone – technology progress ahead of legal frame
 - New knowledge and skills required
 - Wider liabilities range

Welcome in autonomous farming era.

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