



# Envisaging Tomorrow's Agricultural Markets Under Climate Change



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# Global Grain Markets Are Primarily About Supply, Demand, and Expectations

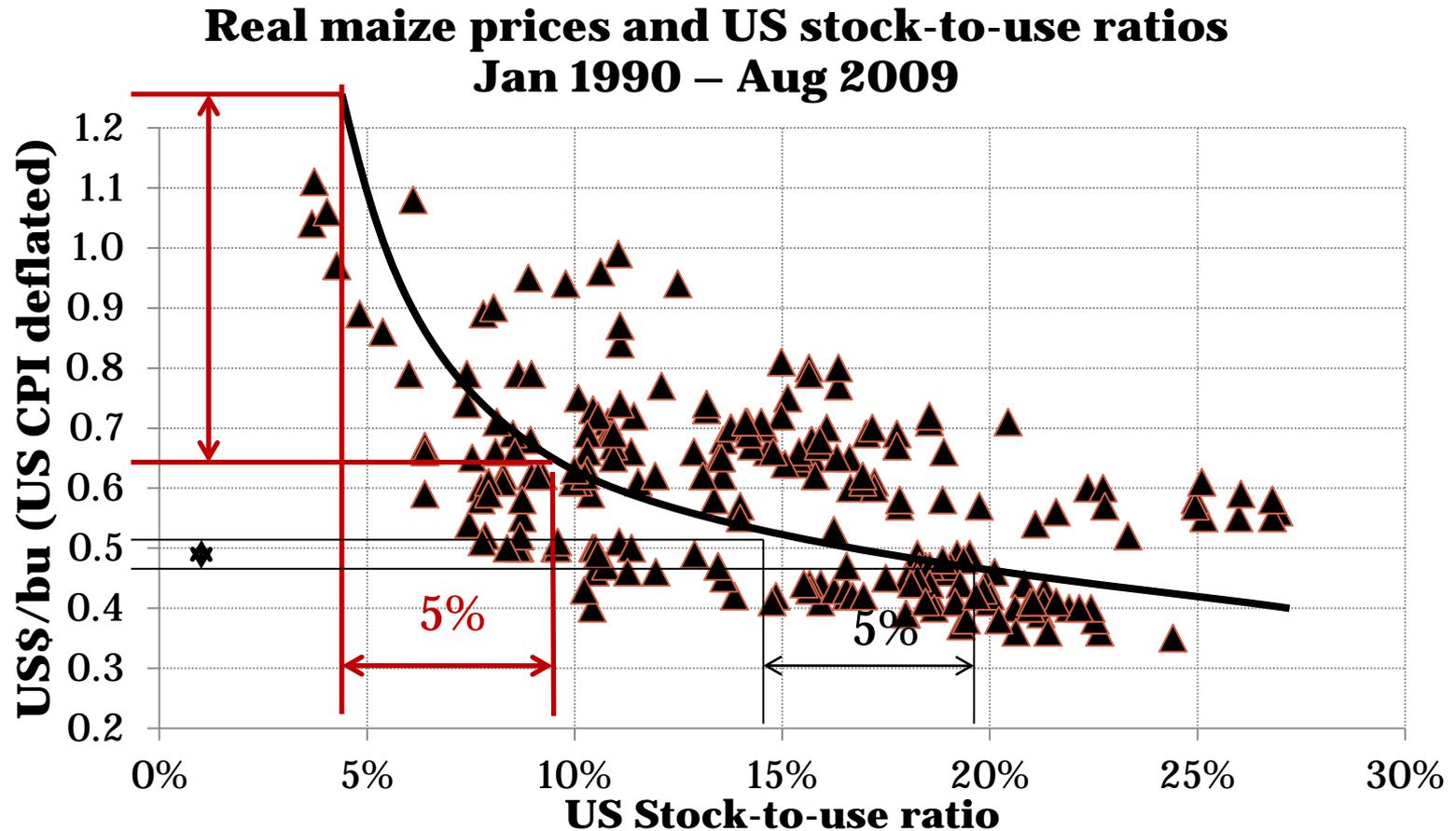
*Rising Grain Demand + Variable Output + Low Stocks in Play* + *Lower Grain Price Responsiveness of Food System Over Time* = *Price Volatility + Likelihood That Prices Stay High*

## Average Annual Growth in %

Annualized Growth (%)	1991-2000	2001-2005	2006-2011	2012/13(e) to 2013/14(e)
World Grain Utilization	1.7%	1.5%	2.3%	USDA: 4.7% FAO: 2.9%
World Grain Output	1.8%	1.5%	1.8%	USDA: 7.7% FAO: 6.5%

Source, USDA. While growth rates over these short term periods may be significantly influenced by start and end points, the longer-term growth rates since 1970 suggest that the period after early 2000s was different.

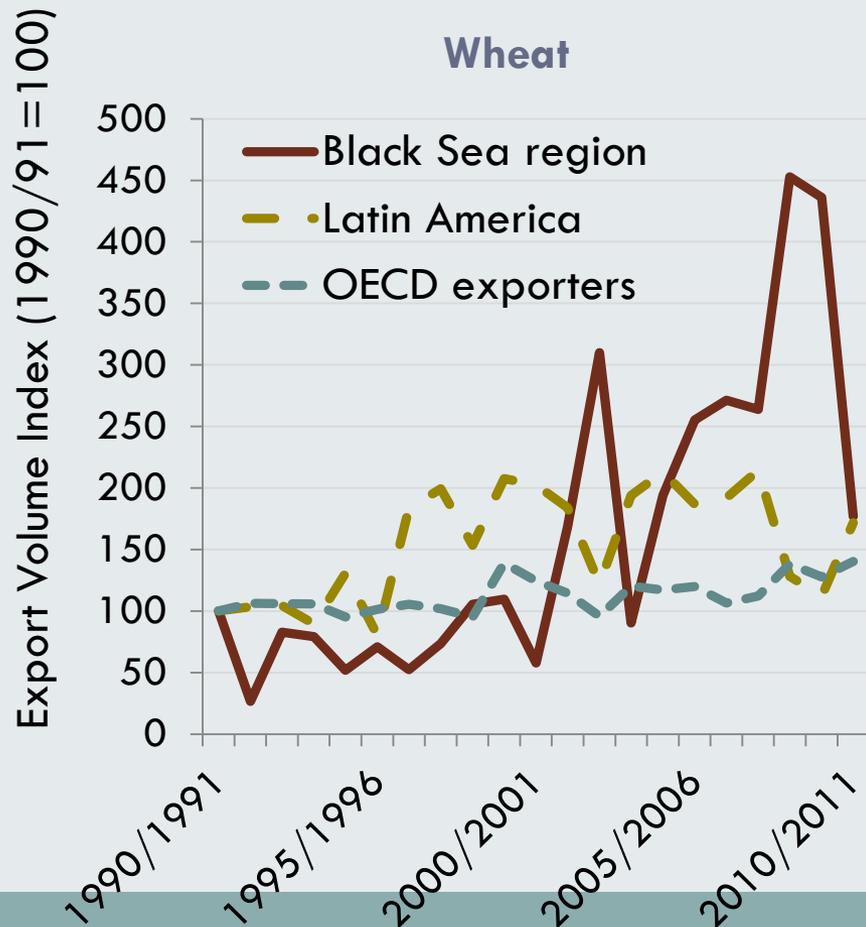
# Expectations: When Stocks Are Low, Nervousness Sets In



Source: FAO, Schmidhuber 2011

# And Most Growth In Grain Exports Since 1990 From Areas With More Variable Climates

Higher wheat export share from more variable Black Sea region and Latin America contributed to recent increase in world export volume volatility



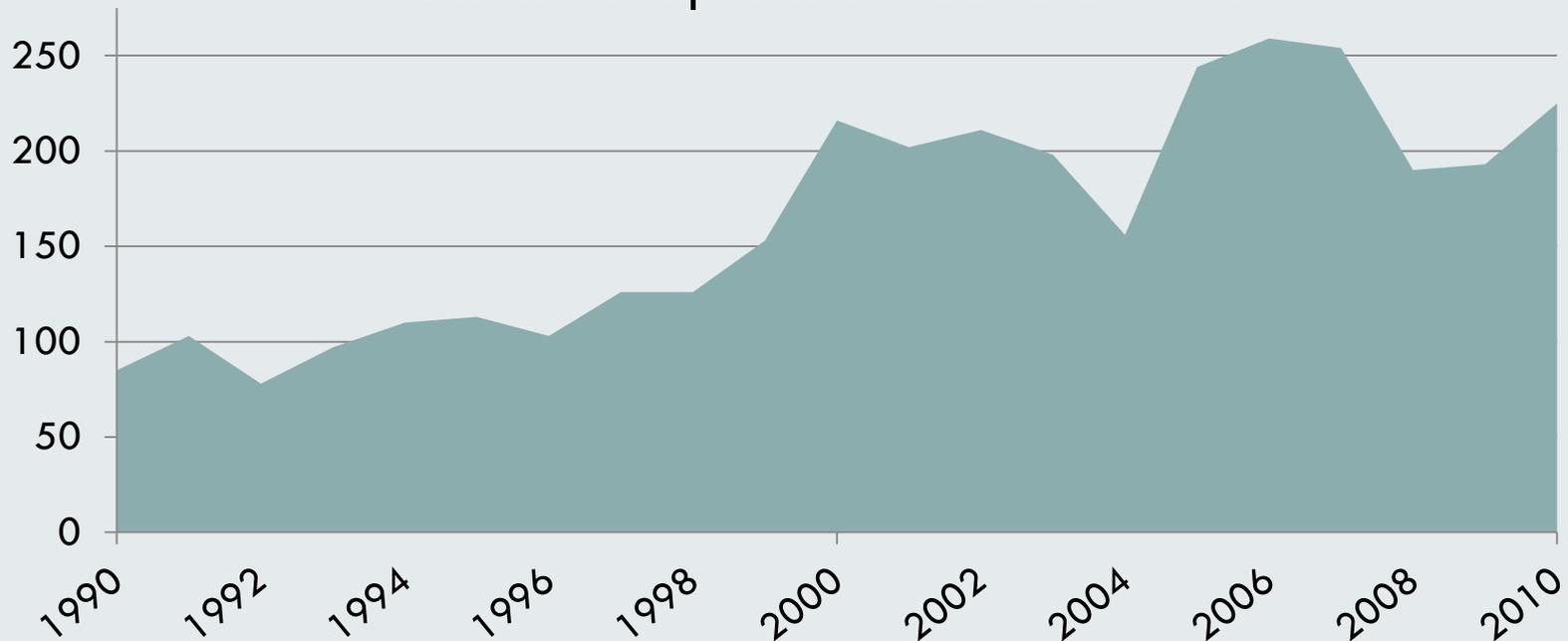
- Wheat export share non-trad exporters increased since 1990s from **11%** to **28 %** in 2010/11 (**35%** projected for 2013/14)
- Wheat export and production volatility higher than OECD
- World wheat export volatility doubled from early 2000s

Source: FAO

# More Variable Weather Over Time



Number of reported occurrences of droughts, floods, and extreme temperatures has increased



Source: [www.emdat.be](http://www.emdat.be). These reported events may reflect both increased occurrence and improvements in reporting.

# Policies Add to Grain Price Volatility



- **Grain trade restrictions in 2008 and 2010/11** significantly reduced the % of the global market that balances international supply and demand
- **Inadequate investments in ag transport** and market infrastructure discourage market responses that dampen price swings
- **Biofuels mandates are spreading** globally (presently 20 countries) and can add rigidity to feedstock demands regardless of profitability
- **Build-up of public grain reserves** in face of rising prices aggravates price rises (widely observed 2008-10)
- **Unpredictable releases onto world market of large publicly controlled stocks of grain** add to uncertainty that reduces private responses (more than half the world's rice and wheat stocks are in India and China, largely under public control)
- **Was the major focus of the 2011 G20** under French Presidency

# The Bottom Line on Int'l Grain Prices

- **Grain prices may slacken a bit this year**, but they will not return to pre-2008 levels in the foreseeable future
- **Uncertainty** about food prices is especially devastating to the poor in developing countries
- Drivers of unpredictable global price volatility have abated a bit **but have not gone away**
- Growing demand will pressure increasingly **constrained supply over time**
- And **risk management at all levels** remains important

# And Global Food & Agriculture Remains About People, Lots of Them

- **Still 870 million hungry** people, 165 m children stunted
- **About as many with incomes** <2005\$ 1.25 a day
- **¾ of these poor live in rural** areas; most of depend on natural resources and farming for their livelihoods
- **The natural capital** they need to survive is degrading or insecure
- **They are extremely vulnerable to climate change**



## **If we fail to act:**

- They are at risk
- Many others will join
- There will be strife

# Need More Food

- **Population increase** of 2 to 3 billion, changing diets and other uses means agric production must grow 50% by 2050
- **Need another 1.2 billion** tons of cereals
- **Need another 200 million** tons of meat
- **Need another 130 million** tons of oilseeds

## Global food demand

To meet global food demand in 2050, agricultural production must be 60 percent higher by weight than in 2005.

*Alexandratos and Bruinsma, 2012*



*F. Fiondella, IRI/CCAFS*



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# This Requires More Agricultural Intensification

- Additional food must come primarily from **intensification on current crop land**
  - **Need another 150 cubic km/yr water**
  - **Need another 100 million tons of NPK**
- (Source: Alexandratos & Bruinsma, FAO)

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# A Crystal Ball: The OECD-FAO Agricultural Outlook to 2022



- **Projects prices, amounts without climate change but with continued high energy prices**
- **Real Prices in 2022 relative to 2010/12:**
  - Animal Products up on the order of 10-15%
  - Wheat down about 25%, Rice down 15%
  - Veg Oils down 20%; Cotton, Coarse Grains, Sugar down about 30%
- **Net Annual Agricultural Growth (relative to 2003-12)**
  - OECD fairly steady at less than 0.8%
  - BRICS doubled to 3% compared to 1.5% previously
  - Least Developed at 4 % compared to 2.8%
  - Global agriculture expected to grow 1.4% p.a.
- **Developing countries = 57% of production growth**

Source: OECD-FAO Agricultural Outlook 2013-2022

# OECD-FAO Agricultural Outlook to 2022 (Continued)



- **Biofuels use up more than 2/3**, projected to consume 28% of sugar cane, 15% of veg oils and 12% of coarse grains in 2022
- **Most production gains of global ag are due to productivity** except sugar and milk
- **80% of increase in meat production** will be in developing countries, half from poultry
- **74% of the growth in milk** will be in developing countries, half in China and India

Source: OECD-FAO Agricultural Outlook 2013-2022

# The China Factor



- **China feeds 20% of global population** on 9% of global arable land and 6% of the fresh water
- **Ag output grew 4.5 times** since 1978
- **The number of malnourished fell 100 million** despite 200 million increase in population since 1990
- **Ag consumption growth per annum** likely to outpace production by 0.3% p.a. through 2022
- **Uncertainties are especially large:** sustainability of high econ growth, resource degradation and severe constraints, **and high susceptibility to climate change**

Source: OECD-FAO Agricultural Outlook 2013-2022, special section in collaboration with the Chinese Academy of Agricultural Sciences

# The China Factor (Cont.)



- **China is expected to surpass the EC** as a per capita consumer of pigmeat by 2022
- **Milk consumption** projected to rise another 38%
- **Dairy imports expected to rise 20%**, with skim and whole milk powder accounting for more than 80% of this
- **Coarse grain imports** beyond the current tariff quota are likely
- **Imports of oilseeds** are expected to rise another 40% to 2022, accounting for 59% of global trade
- **Cotton area is expected to decline 21%**, a reversal of the previous decade as textiles shift to South Asia.

Source: OECD-FAO Agricultural Outlook 2013-2022, special section in collaboration with the Chinese Academy of Agricultural Sciences

# So Things Seemed to Be Looking Up for Both Food Producers and Consumers...



- **With widespread improvements in Total Factor Productivity** in Global Agriculture Since 1990
- **And significant improvement in global agricultural policies** since 1990s, especially in developing countries
- **Seriousness of purpose globally towards ag and food since 2008**
- **And partial attainment of poverty and hunger MDGs**
- **And the BRICS like China, increasingly important** to both growing ag consumption and production, are increasingly open

# **Yet Apparent Acceleration in Climate Change May Threaten Much of What Has Been Achieved**



- **Climate Change of 2 degrees C could send World backwards with reductions in food per capita of the order of 10-20% perhaps as soon as 2050**
- **Some effects as in SE Asia may happen by 2030 instead of 2050 as thought before**
- **Effect on Developing Country economies would devastate agricultural trade**
- **And Climate Change of 4 degrees is a real possibility by 2100 (World Bank 2013 report from Potsdam Institute—"Turn Down the Heat")**

# Danger of 5 % Lower Crop Yields From Each Degree Celsius Of Global Warming!

- **Each day above 30 deg. C reduces the yield of maize by 1% to 1.7 % depending on rainfall (Lobell et al. 2011).**
- **Flooding already affects up to 15 million hectares of rice fields in South and SE Asia, an estimated \$1 billion in yield losses per year.**
- **35 million African farmers must switch from mixed farming systems to livestock only by 2050 (Jones and Thornton 2008).**

## Impacts on crops

Global impacts of climate change on yields cannot be estimated due to variation among locations and crop types. But the overall impact on grain is negative—the potential yield loss is about 5 percent for each degree Celsius of global warming.

*Lobell et al., 2011*



*Neil Palmer, CIAT*

# Est. Impacts of 2 Degree C. Climate Warming on Cereal Yields in South Asia by 2050

Crop	Production in 2000 (mmt)	Projected annual yield growth WITHOUT climate change	Projected annual yield growth WITH climate change
Rice	120	0.9%	-0.2%
Wheat	97	1.6%	-1.3%
Maize	16	0.6%	0.1%

Note: Assumes no additional CO2 fertilization effect under climate change.

**Implies about a 1/3 decrease in cereals production per capita under CC!**

Source: Nelson et al. 2010 (IFPRI)

# Recent Flooding and Salt Water Intrusion in the SE Asia Rice Bowl Augurs Ominously



<b>Delta</b>	<b>Land area of Basin (km<sup>2</sup>)</b>	<b>% of area with recent storm surges</b>	<b>% of area with recent river flooding</b>	<b>National % of Global Rice Production in 2013/14 (e) (FAO est.)</b>
Irawaddy, Myanmar	20,571	73%	37%	4%
Mekong, Vietnam	40,519	24%	91%	6%
Chao Praya, Thailand	11,329	7%	35%	5%

Note: The 3 countries are projected to account for 42% of gross global rice exports in 2013 (FAO). Sea level rise is projected to exceed 30 cm well before 2050 with rice cropped area losses in the range of 6-12%.

Source: World Bank, 2013 and FAO, 2013.

# Tropics Most Vulnerable to Climate Chg.



**The WB's Clients Get It...!  
25 MMT of Food Grains Lost  
Per Year 2008-2011**



# Some Conundrums for Ag Under Climate Change



- **Ag writ large is a major contributor to CC:** forestry, crops, livestock and fisheries emissions are **roughly 25-30% of TOTAL GHG!**
- **Global GHG can only be controlled at scale with help from ag/forestry,** the only sector that sucks up atmospheric carbon at scale
  - Otherwise the stuff that accounts for the other 70% of GHG needs to be cut that much more (i.e. 40% more effort!)
- **It can be done:**
  - **integrated** crop, tree, land, and water management, better weather forecasting, drought- and flood-tolerant crops and risk insurance.
- **But can ag mitigate CC without participation of 500 million small farms in poor countries?**
  - Only if the (less than) 50% of global ag from the rest does it all

# Need Everywhere Going Forward: Climate Smart Agriculture



- **Improve crop yields & livestock mgt to increase production**
- **Increase climate resilience of farming systems**
  - Water efficiency and management at a landscape level
  - Drought/flood tolerant varieties
- **Reduce carbon emissions**
  - Livestock mgt to reduce methane
  - Better use organic fertilizer, conservation agriculture, to reduce nitrous oxide
- **Increase soil carbon storage (raise incomes)**
  - Build capacity to measure and value carbon (assessed against costs trade-offs among other actions to reduce emissions)
  - Assess incentive structure for soil carbon sequestration

# Need in Developing Countries: Facilitation of Private Sector Response

- **Promote private sector investment**
  - Fair land rights, responsible investment, and infrastructure
- **Foster private agriculture service provision**
  - Grants to farm communities to contract private providers
- **Improve investment climate for agriculture & rural businesses and for associated jobs**
  - Agriculture and rural business indicators
  - Improve regulatory environment along value chains (inputs, food safety, food product standards)
  - Prioritize infrastructure and logistics (especially Africa)
  - Vocational training to meet supply chain skills
- **Improve access to finance**
  - Value chain integrated solutions
  - Advisory support to financial intermediaries (e.g. warehouse, commodity, input financing schemes)
  - Increasing access to insurance products

# Messages for Agricultural Policy



- Food price volatility increasingly a **long-term phenomenon** given **inadequate supply response in developing countries to growing demand**
- **Increased long-term investment in agricultural productivity and market access is key. Need:**
  - **Building trust in mutual benefit through** less hindered trade, more transparent market information, better business environment
  - **Increased attention to risk management**, especially for the most vulnerable, but for everyone
  - **Specific promotion of investment in climate smart agriculture technologies and policies** for greater resilience of ag production and livelihoods everywhere
  - **Shift policy incentives to promoting triple wins:** more productivity, resilience, and mitigation of CC from ag investments

# Key Areas of World Bank Agricultural Emphasis Going Forward: Help Clients To:



- **Climate-proof agriculture**, increasing resilience of systems and rural livelihoods at the same time as increasing productivity and bolstering biodiversity
- **Manage and mitigate increased levels of agricultural and environmental risks** (price, weather, pollution etc.)
- **Leverage private sector response** in the provision of agricultural & environmental public goods
- **Join global partnerships** to harmonize and align efforts around productivity increases, better resiliency, food security, and CC mitigation.



Thank you



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