The Emerging Role of Kazakhstan, Russia and Ukraine in Global Food Security to 2050

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Technology and agricultural investment challenges in Europe and Central Asia

William Meyers, Monika Tothova and Kateryna Goychuk

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Food and Agricultural Policy Research Institute
FAPRI

College of Agriculture, Food and Natural Resources

Outline of presentation

- Production growth needed by 2050
- Analysis of yields in the region
- More land or more technology?
- What can be done?

Need depends where, what "Food"

Category	2005/07	2050	% Growth
World population (bil)	6.37	8.80	38
food production			**70**
crop production			66
cereal production (mil ton)	2012	3009	**49**
meat production (mil ton)	249	461	85
Developing country pop (bil)	5.04	7.43	48
food production			**97**
cereal production	1113	1797	**61**
Developed country pop (bil)	1.33	1.36	2
food production			23
cereal production (mil ton)	900	1212	35

Exponential growth rates in grain production, world with and without FSU

Region	1960-70	1970-80	1980-90	1990-00	2000-09
World	3.28	2.81	1.63	**0.82**	2.28
FSU 12	3.74	0.97	2.10	**-5.93**	3.57
World less FSU 12	3.21	3.09	1.58	**1.41**	2.19

Analysis of the region

- Varied geographical, natural, and social backgrounds
  - => variety of agricultural systems
- Important players on the world's grain markets
  - => some aim to be among the biggest exporters
- BUT: yield variability in the region is high
- A propensity to employ trade restrictive policies, generates increased world price volatility
- Unlike many regions, KRU can still benefit from improved management practices and maybe land expansion.
- Outline possible steps to be taken in the area of technology and investment

Evidence of decreasing yield growth?

- Analysed yields of a variety of commodities over the last 50 years
- geopolitical changes make analysis difficult
  - one cannot compare average yield growth in the Former Soviet Union – an average of a variety of natural conditions – with an average yield, for example, in Kazakhstan or Ukraine.
- Yield data for the analysis from FAOSTAT
  - Time series were limited by the data availability as of January 2012 to 1961 – 2010
  - In most cases the end points were three-year averages

What was analyzed?

- Yield growth rates
- Average yields comparing KRU other countries and the world
- Yield gaps between the actual yields in the region and the world average
- Variability of actual yields in selected countries
  - Yield analyses did not account for climatic, soil and other conditions but provide an indication

How?

- 4 equal 11-year time periods corresponding broadly to different economic periods:
  - 1961-1972 capturing the **green revolution**,
  - 1973-1984 the aftermath of the **two energy shocks and stagflation**,
  - 1985-1996 **collapse of USSR**, the recovery of agricultural prices until their mid-1990s spike, and finally
  - 1997-2008 representing the parallel boom in agricultural and other markets and agricultural **price spike of 2007-2008.**
- 4 equal 5-year time periods on the 1985 – 2009 period

Growth rate analysis: world level

- Yields are in most cases continuing to increase
- No straightforward conclusions can be drawn regarding the **slowdown of yield growth** for many commodities **on the world level**. .
- 10 year intervals – highest growth rates in early years of the green revolution BUT did not follow a steady decline like in case of wheat and soybeans.

Rates of world yield growth for selected crops and 11 year periods from 1961-2009

World	11 year periods				
	61/62-08/10	61/62-71/73	72/74-83/85	84/86-95/97	96/98-07/09
Barley	1.3%	2.6%	1.0%	0.4%	0.9%
Maize	2.0%	2.9%	2.2%	1.0%	1.6%
Rapeseed	2.5%	3.3%	3.7%	1.1%	2.4%
Rice, paddy	1.7%	2.1%	2.6%	1.3%	1.1%
Sorghum	0.9%	2.8%	1.4%	-0.6%	-0.1%
Soybeans	1.6%	2.7%	1.4%	1.4%	0.7%
Sunflower	0.6%	1.2%	0.3%	-0.3%	0.9%
Wheat	2.1%	3.3%	2.6%	1.4%	1.0%

Source: Calculated by the author from FAOSTAT data (accessed January 2012)

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- 10 year intervals – highest growth rates in early years of the green revolution BUT did not follow a steady decline like in case of wheat and soybeans.
- 5 year intervals – highest growth rates usually in recent years showing response to higher prices

Rates of world yield growth for selected crops and 5 year periods from 1961-2009

World	5 year periods				
	84/86-08/10	84/86-89/91	90/92-95/97	96/98-01/03	02/04-07/09
Barley	0.9%	0.9%	-0.1%	0.8%	0.9%
Maize	1.5%	0.2%	1.5%	0.8%	2.0%
Rapeseed	1.6%	1.2%	1.1%	1.7%	2.5%
Rice, paddy	1.2%	1.6%	1.1%	0.5%	1.8%
Sorghum	-0.2%	-2.1%	-0.3%	-1.4%	1.0%
Soybeans	1.2%	0.6%	1.7%	1.1%	0.7%
Sunflower	0.3%	1.4%	-0.9%	-0.5%	2.0%
Wheat	1.3%	1.9%	0.7%	0.4%	1.5%

Source: Calculated by the author from FAOSTAT data (accessed January 2012)

Growth rate analysis: country level

- Yield growth rate developments on the country level remain rather **heterogeneous**
- Cannot say with certainty whether decreasing yield growth was due **technology or weather** related events,
  - NOTE disinvestment following structural changes in Eastern Europe and former Soviet Union.
- **Transition economies** show bottoming yield growth rates in the 1985 – 1996 period, followed by a recovery in 1997 – 2008.
- **Growth rates** in many transition economies during the 1991 – 1996 and 1997 – 2002 were in fact **negative**.
- With the entry to the EU many former transition economies reversed their declining growth rates.

Wheat	Average yield per period				
	1961-2009	1961-1972	1973-1984	1985-1996	1997-2008
Kazakhstan				0.85	1.00
Portugal	1.31	0.96	1.11	1.61	1.50
Russian Federation				1.61	1.89
Romania	2.40	1.69	2.54	2.69	2.65
Ukraine				3.05	2.66
Belarus				2.49	2.71
Spain	2.01	1.18	1.68	2.36	2.76
Turkmenistan				1.76	2.76
Bulgaria	3.18	2.47	3.77	3.43	3.04
Albania	2.45	1.30	2.49	2.78	3.08
Lithuania				2.50	3.37
Uzbekistan				1.66	3.44
Poland	3.14	2.22	3.04	3.55	3.65
Hungary	3.73	2.30	4.08	4.49	4.02
Slovakia				4.32	4.05
World + (Total)	**2.12**	**1.35**	**1.85**	**2.42**	**2.79**

Wheat	% deviation from world average				
	1961-2009	1961-1972	1973-1984	1985-1996	1997-2008
Kazakhstan				-64.8%	-64.1%
Portugal	-38.39%	-29.03%	-39.75%	-33.6%	-46.2%
Russian Federation				-33.4%	-32.5%
Romania	12.80%	25.25%	37.19%	11.2%	-5.0%
Ukraine				25.8%	-4.8%
Belarus				2.6%	-3.1%
Spain	-5.42%	-12.91%	-8.98%	-2.5%	-1.3%
Turkmenistan				-27.2%	-1.1%
Bulgaria	49.72%	82.60%	104.03%	41.8%	8.8%
Albania	15.16%	-3.90%	34.87%	14.6%	10.2%
Lithuania				3.1%	20.5%
Uzbekistan				-31.5%	23.1%
Poland	47.70%	63.97%	64.39%	46.5%	30.8%
Hungary	75.43%	70.24%	120.53%	85.1%	44.0%
Slovakia				78.2%	45.0%

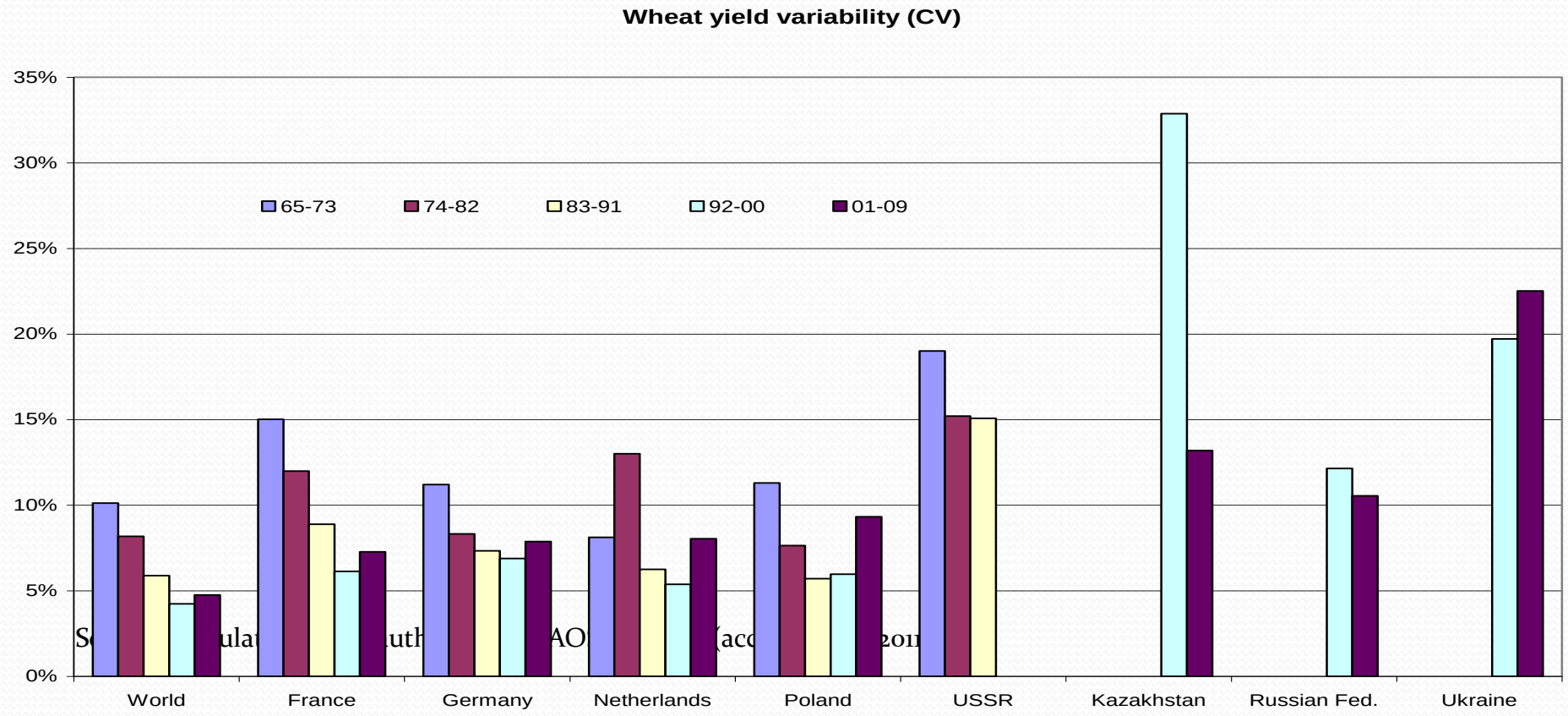
Average yields

- K and R are producing 30-60 % the world average **wheat** yields
- KR and U all 16-30 % below world average **maize** yields
- KR and U all 16-56 % below world average **barley** yields
- KR and U all 8-58 % below world **sunflower** yields
- KR and U all 26-60% below world **soybean and rapeseed** yields

Yield variability

- Production is shifting from "traditional" countries to countries with higher yield variability which is likely to influence **price volatility** in the future.
- Calculated the **coefficient of variation** for key countries
- In many countries **yield variability decreases** over the years - improved genetics and management practices.
- But in KRU, yield **variability is usually higher** than in other countries.

Wheat yield variability in selected ECA countries over several periods 1965 to 2009



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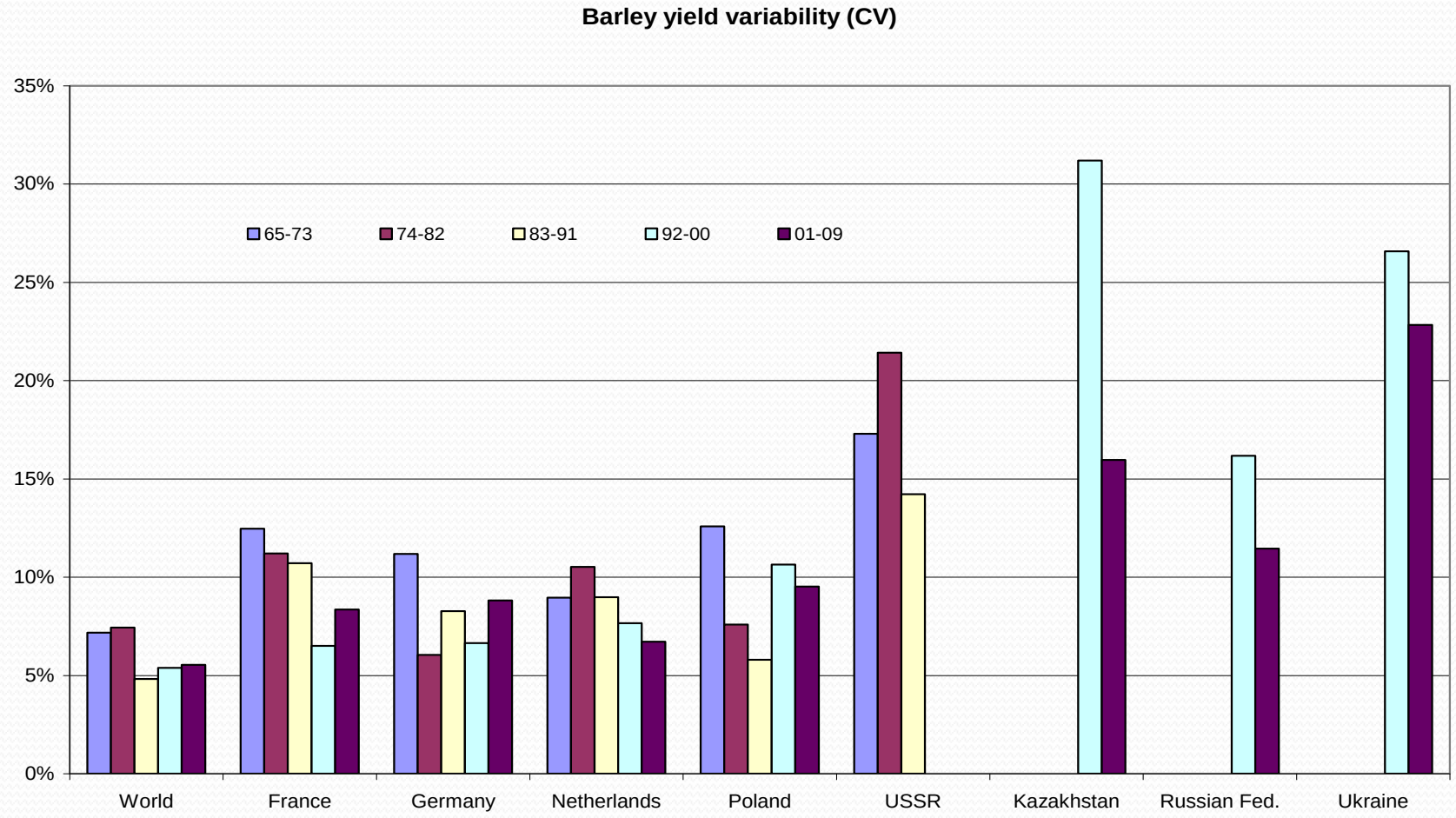
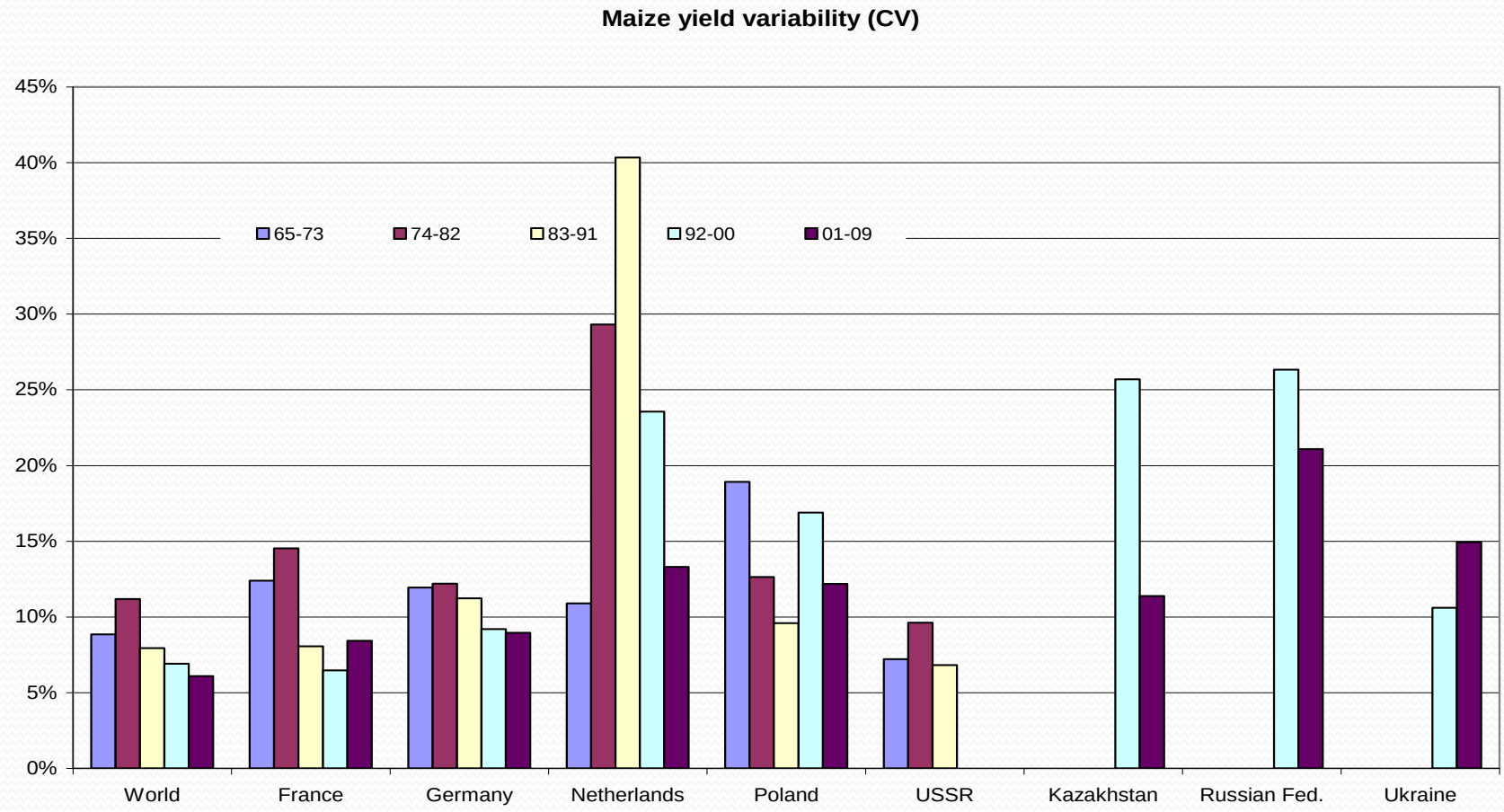
Barley yield variability in selected ECA countries over several periods 1965 to 2009



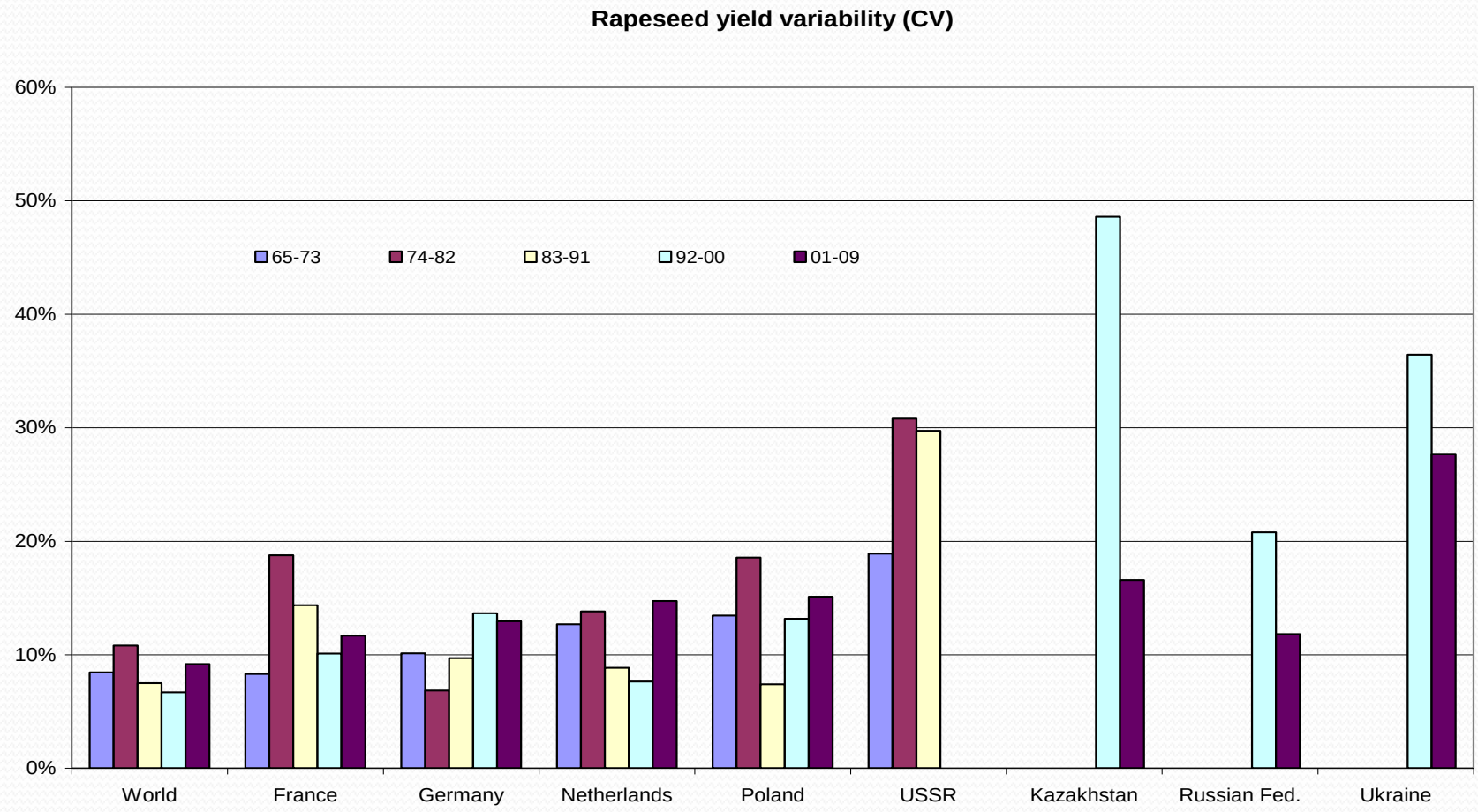
Source: Calculated by the authors from FAOSTAT data (accessed Oct 2011)

Maize yield variability in selected ECA countries over several periods 1965 to 2009



Source: Calculated by the authors from FAOSTAT data (accessed Oct 2011)

Rapeseed yield variability in selected ECA countries over several periods 1965 to 2009



Source: Calculated by the authors from FAOSTAT data (accessed Oct 2011)

More land or more technology?

- Strong competition among crops
- Marginal lands
  - High potential for environmental degradation
  - Small production potential and not economic
- High cost of bringing productive but long uncultivated land – back to production
- Limited scope but high prices stimulate expansion if they continue
- More potential in pushing the agricultural technology frontier

Technological development

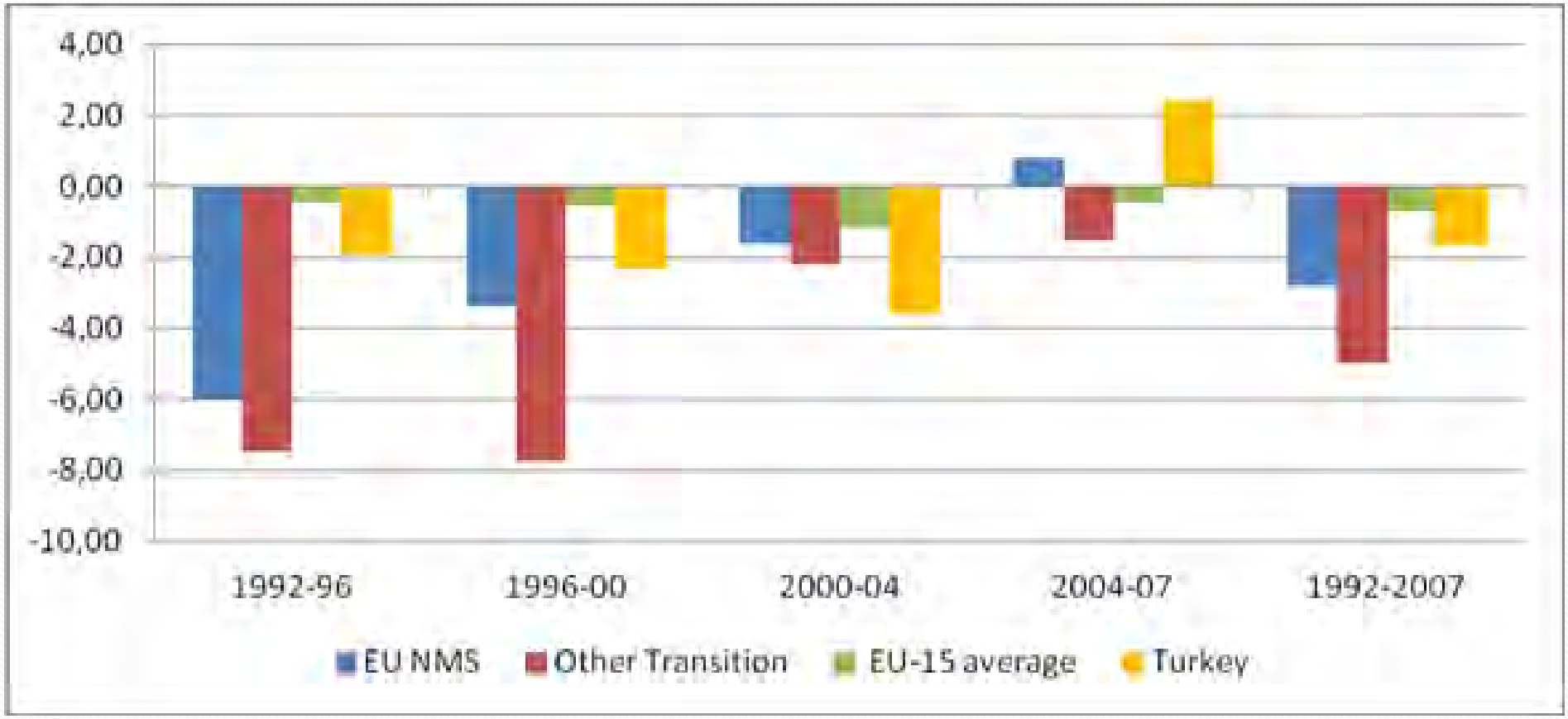
- "**Demand-pull":** the needs of the marketplace create the demand for a product. Both public and private-sector scientists, inventors, and entrepreneurs often seek to meet this demand.
- "**Supply-push":** the impetus comes from scientists and inventors who find a new and valuable technology. This technology can then be introduced into the marketplace.
- **Improved technology** is needed as well **as improving farming practices** using current technology

Growth in Agr Capital Stock

Country	1992-96	1996-00	2000-04	2004-07	1992-2007
EU New Member States	-1.53	-0.62	-0.10	0.63	-0.48
Kazakhstan	0.32	-4.54	0.51	0.56	-1.34
Russia	-4.13	-4.74	-1.24	-0.81	-2.76
Ukraine	-2.49	-5.31	-2.37	-1.22	-3.32

Source: Cramon-Taubadel, S, et al (2009)

ACS Growth rated in livestock, % per annum



What can be done?

- Investment in Agricultural Capital Stock
  - Mostly private- e.g. agriholdings
  - But government needs to provide investment climate
- Investment in R&D
  - Significant public role
  - Also need investment climate for private R&D
- Improved Agr. Knowledge Systems
  - Mainly public role
  - Private role can be facilitated by government

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Thank you!

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