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Productivity Growth and Variability in KRU: Evidence and Prospects

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Production growth

- Population growth, demand growth
- Lagging supply influenced by weather conditions

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

Analysis of the KRU 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.

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

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 May 2013 to 1961 – 2011
 - In most cases the end points were three-year averages

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

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

| World | 11 year periods | | | | |
|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | 61/62- 08/11 | 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% | 2.3% | 1.0% | 1.6% |
| Potatoes | 0.9% | 1.6% | 0.5% | 0.3% | 0.8% |
| Rapeseed | 2.4% | 3.3% | 3.7% | 1.1% | 2.4% |
| Soybeans | 1.6% | 2.8% | 1.4% | 1.4% | 0.7% |
| Sunflower | 0.7% | 1.2% | 0.3% | -0.3% | 0.9% |
| Wheat | 2.0% | 3.3% | 2.6% | 1.4% | 1.0% |

Source: Calculated by the author from FAOSTAT data (accessed May 2013)

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 5 year periods from 1985-2009

| 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 | 0.8% | 0.9% | -0.1% | 0.8% | 1.0% |
| Maize | 1.5% | -0.7% | 1.5% | 0.8% | 2.1% |
| Potatoes | 0.7% | 1.2% | 1.5% | 0% | 1.1% |
| Rapeseed | 1.4% | 1.2% | 1.1% | 1.7% | 2.6% |
| Soybeans | 1.1% | 0.6% | 1.7% | 1.1% | 0.8% |
| Sunflower | 0.2% | 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 May 2013)

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.
- Growth rates in many transition economies during the 1991 – 1996 and 1997 – 2002 were in fact negative.

| Wheat | Rates of yield growth | | | | |
|-------------------|-----------------------|-----------|-----------|-----------|-----------|
| | 1985-2010 | 1985-1990 | 1991-1996 | 1997-2002 | 2003-2008 |
| Spain | 0.9 | -0.3 | -0.2 | -0.1 | 1 |
| Canada | 1.5 | 2.6 | 0.3 | -2.4 | 3.4 |
| France | 0.8 | 1.7 | 0.7 | -1 | -0.4 |
| Argentina | 2.6 | 0.9 | 1.2 | -1 | 0.8 |
| Germany | 0.9 | 1 | 2.4 | -0.4 | 1.2 |
| Italy | 1 | 0.4 | -1.3 | -2.3 | 2.6 |
| USA | 0.8 | -0.8 | -0.3 | 0.1 | 1.1 |
| Australia | 0.9 | 1.4 | 3.5 | -3.3 | -1.4 |
| <i>Kazakhstan</i> | | | -12.1 | 10 | 3.2 |
| <i>Russia</i> | | | -3.5 | 4.2 | 3.6 |
| <i>Ukraine</i> | | | -2.7 | -0.4 | 3.5 |
| World + (Total) | 1.3 | 1.9 | 0.7 | 0.4 | 1.5 |

| Wheat | Average yield per period | | | | |
|-------------------|--------------------------|-------------|-------------|-------------|-------------|
| | 1961-2010 | 1961-1972 | 1973-1984 | 1985-1996 | 1997-2008 |
| Ireland | 6.49 | 3.73 | 5.36 | 7.53 | 8.73 |
| Belgium | 6.21 | 3.99 | 5.08 | 6.81 | 8.27 |
| Netherlands | 6.78 | 4.44 | 6.19 | 7.85 | 8.19 |
| UK | 6.14 | 4.04 | 5.41 | 6.98 | 7.76 |
| US | 2.37 | 1.88 | 2.23 | 2.45 | 2.78 |
| <i>Ukraine</i> | 2.81 | | | 3.05 | 2.66 |
| Argentina | 1.96 | 1.38 | 1.70 | 1.98 | 2.44 |
| Canada | 2.01 | 1.55 | 1.84 | 2.05 | 2.39 |
| Brazil | 1.37 | 0.78 | 0.93 | 1.55 | 1.92 |
| <i>Russia</i> | 1.86 | | | 1.61 | 1.89 |
| <i>Kazakhstan</i> | 0.99 | | | 0.85 | 1.00 |
| World + (Total) | 2.16 | 1.35 | 1.85 | 2.42 | 2.79 |

| Wheat | % deviation from world average | | | | |
|-------------------|--------------------------------|-----------|-----------|------------|------------|
| | 1961-2010 | 1961-1972 | 1973-1984 | 1985-1996 | 1997-2008 |
| Ireland | 200 | 176 | 190 | 211 | 213 |
| Belgium | 187 | 195 | 175 | 181 | 196 |
| Netherlands | 214 | 228 | 235 | 224 | 193 |
| UK | 184 | 199 | 192 | 188 | 178 |
| US | 10 | 39 | 20 | 1 | -0.6 |
| <i>Ukraine</i> | 30 | | | 28 | -5 |
| Argentina | -9 | 2 | -8 | -18 | -13 |
| Canada | -7 | 15 | -0.6 | -15 | -15 |
| Brazil | -37 | -42 | -50 | -36 | -31 |
| <i>Russia</i> | -14 | | | -33 | -33 |
| <i>Kazakhstan</i> | -54 | | | -65 | -64 |

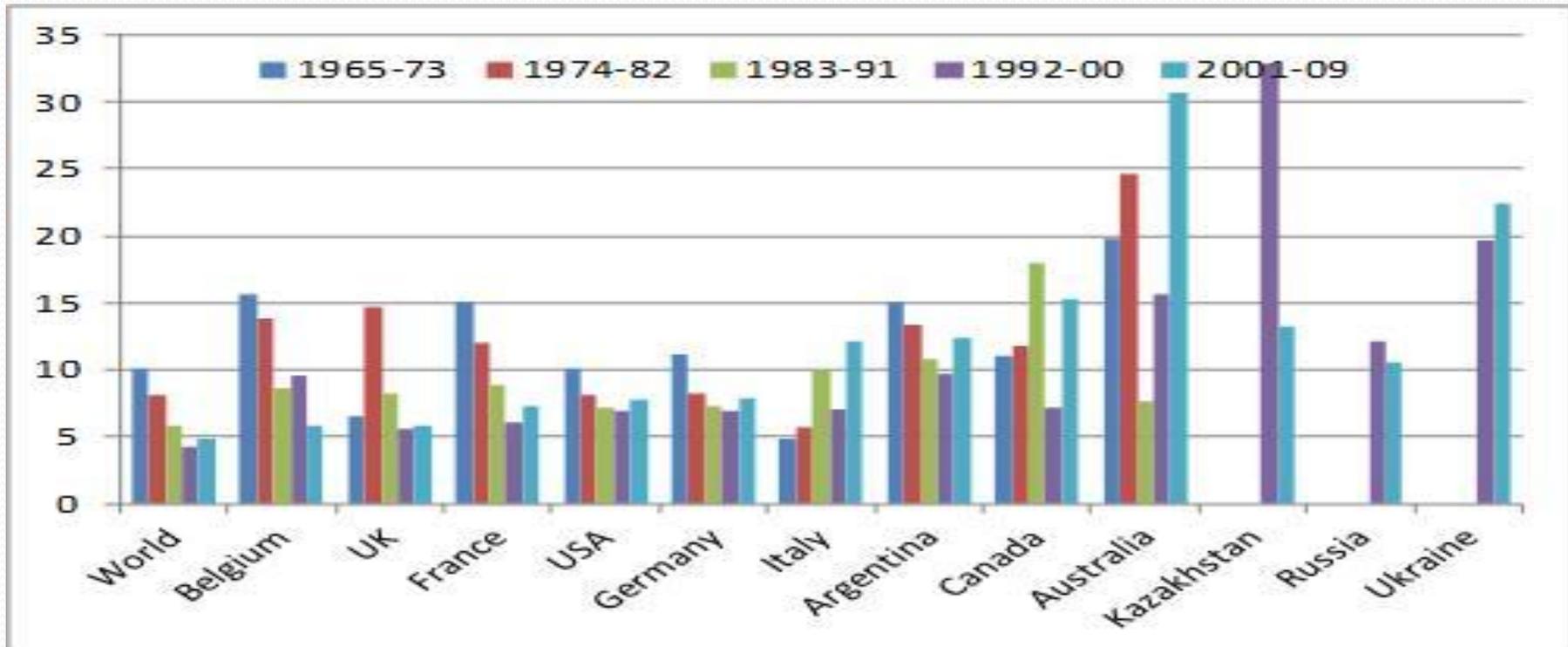
Average yields

- 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

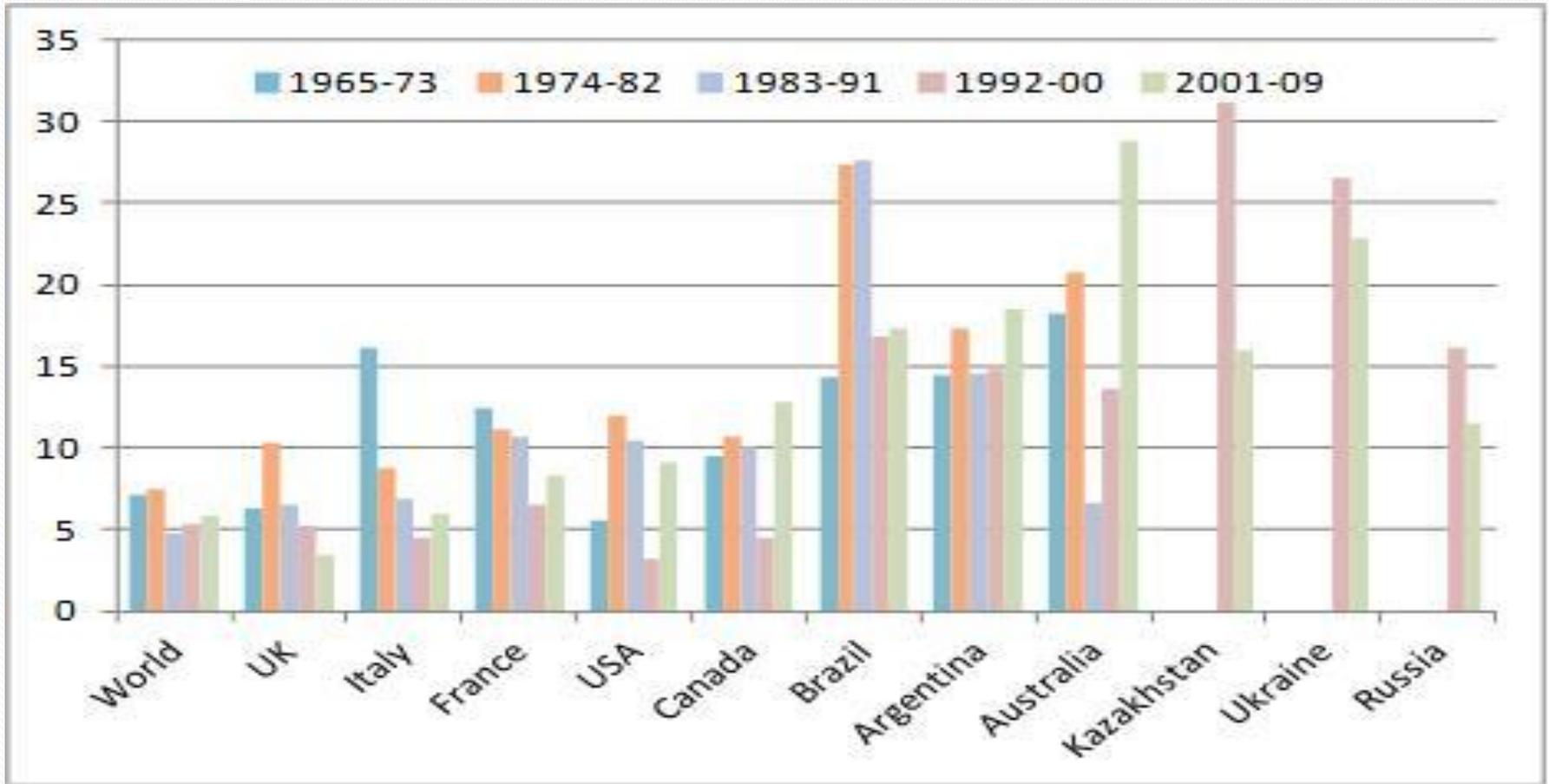
- Production is shifting from "traditional" countries to countries with higher yield variability which is likely to influence **price volatility** in the future.
- Calculated the **coefficient of variation** for key countries
- In many countries **yield variability decreases** over the years - improved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

Wheat yield variability in selected countries over several periods 1965 to 2010



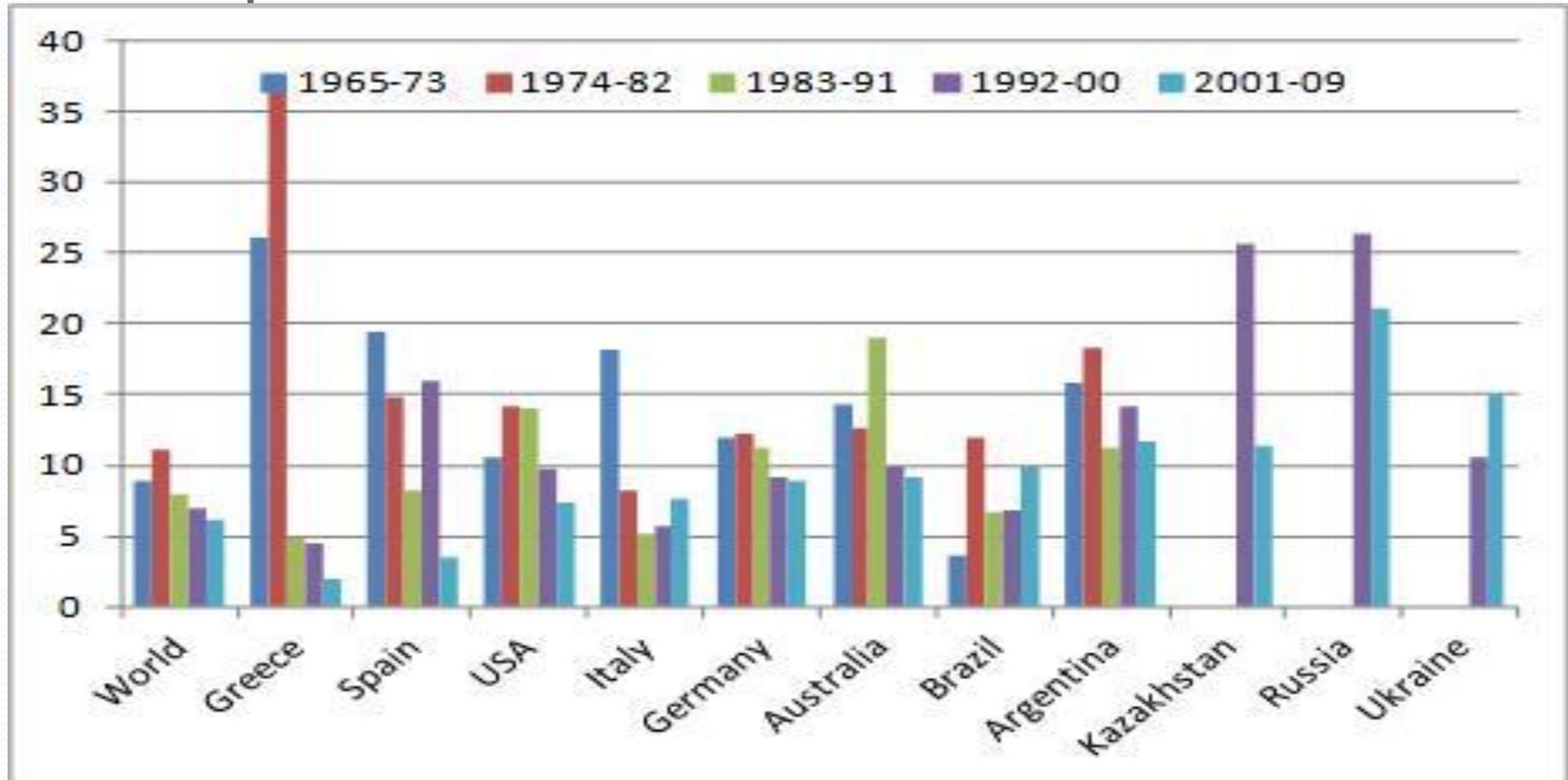
Source: Calculated by the authors from FAOSTAT data (accessed May 2013)

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



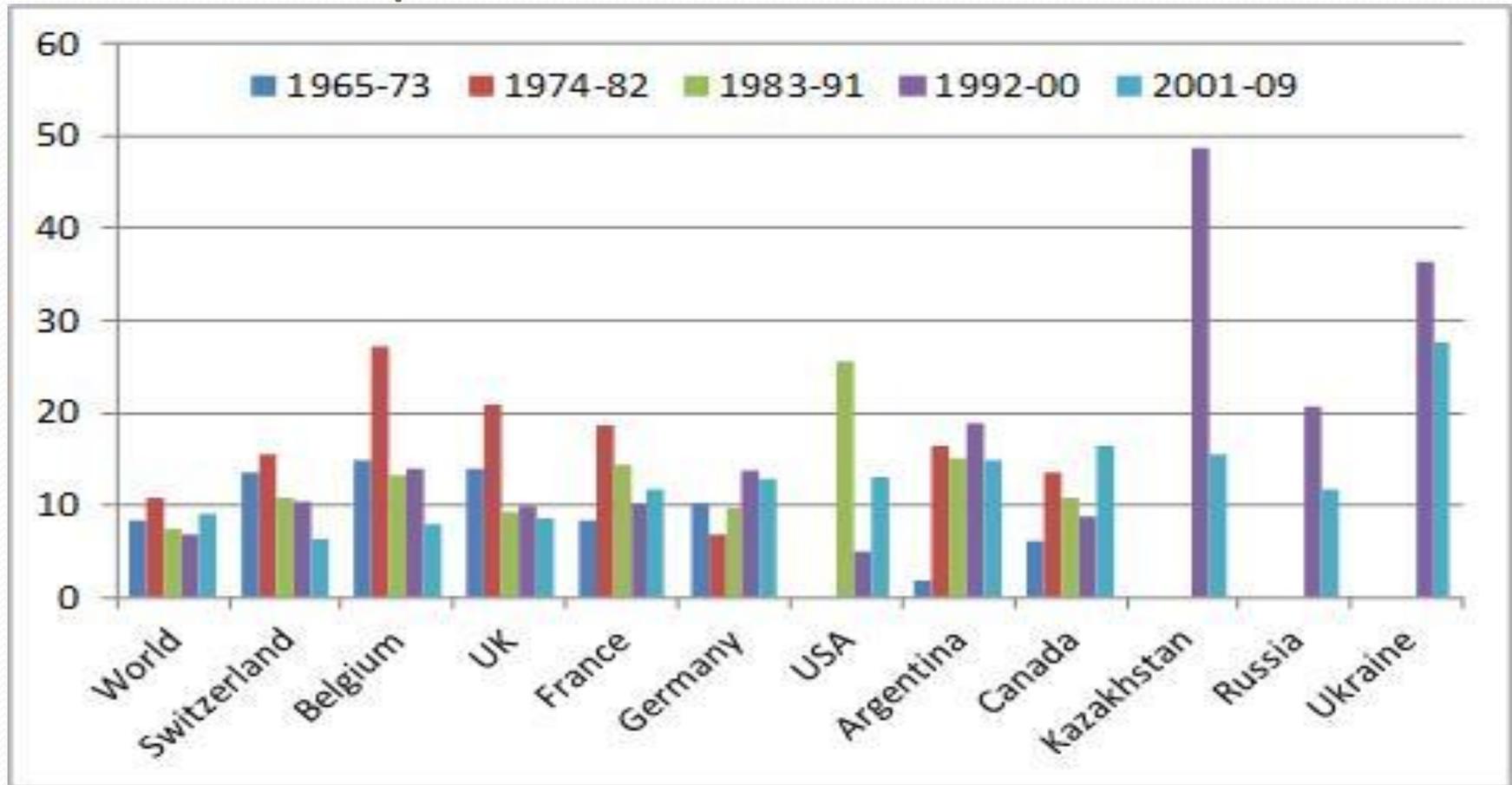
Source: Calculated by the authors from FAOSTAT data (accessed Oct 2011)

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



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

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



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

What can be done?

- support to agricultural and policy environment
- Increases in productivity
 - R&D investment
- Supporting and increasing investment in agriculture
 - Agriholdings
 - Improvements in investment climate
- Improved Agr. Knowledge Systems
 - Mainly public role
 - Private role can be facilitated by government

Thank you!

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