How well is the Russian wheat market functioning? A comparison with the corn market in the USA

MIRANDA SVANIDZE AND LINDE GÖTZ

Russia's wheat exports

IAMO
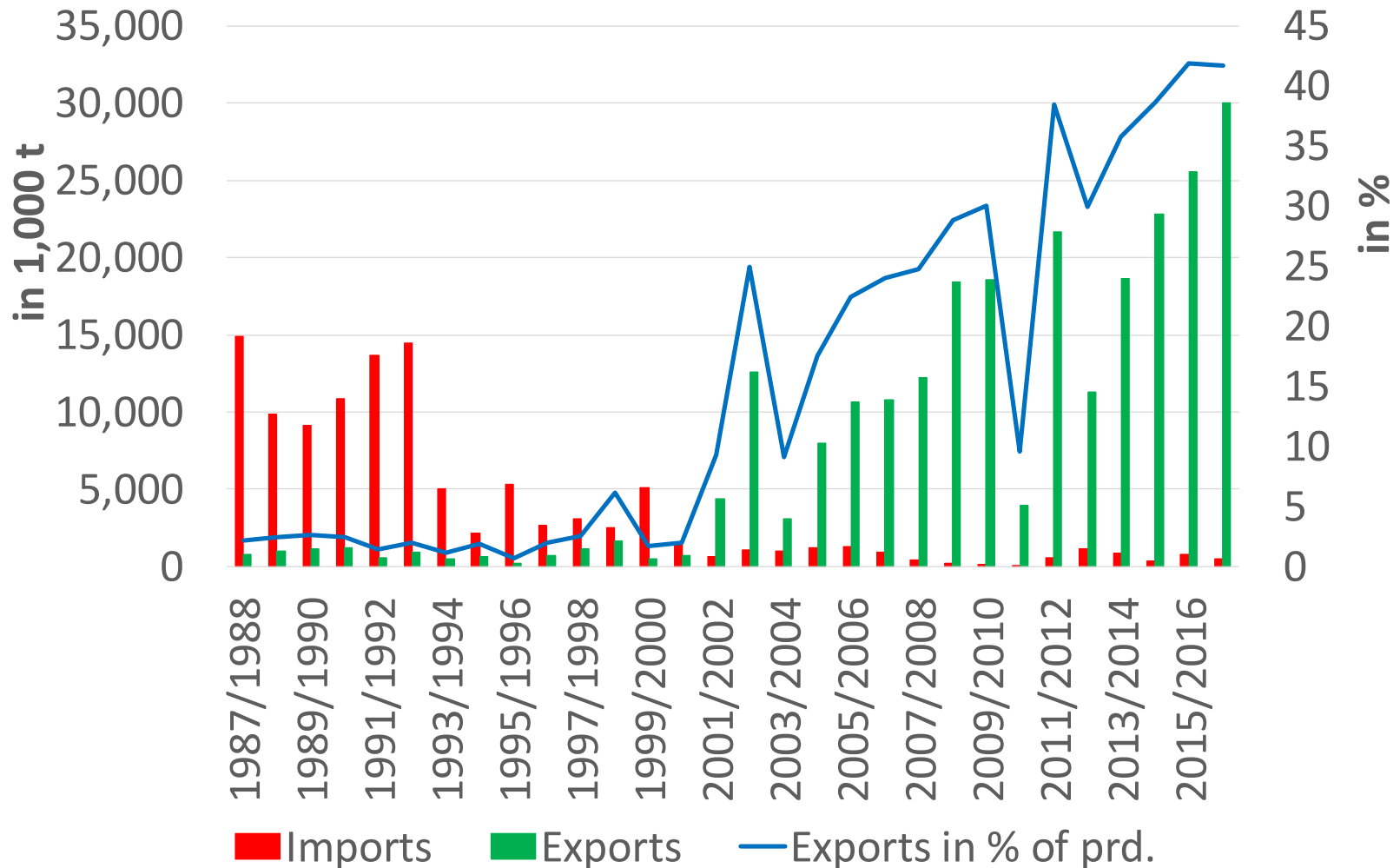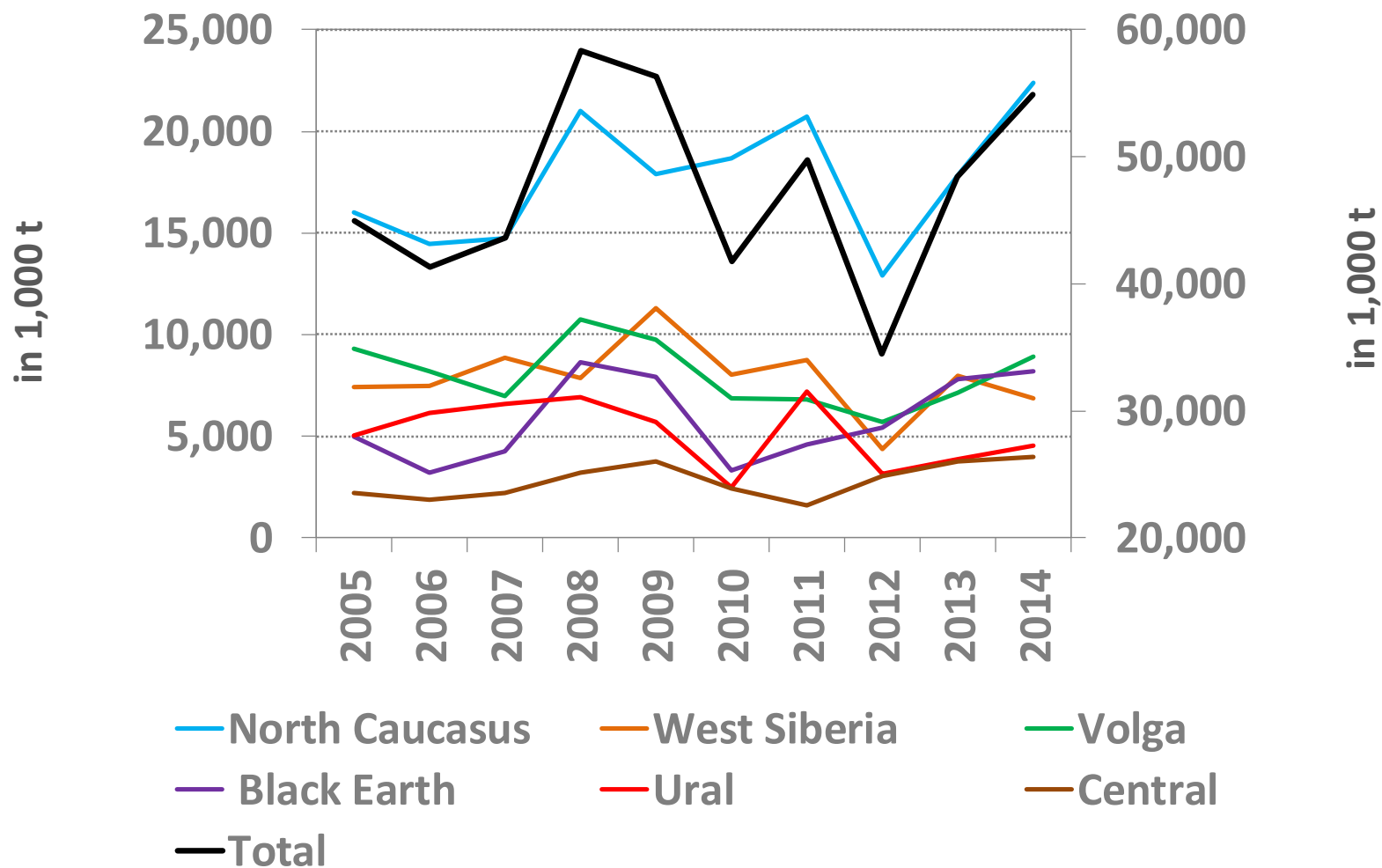Leibniz Institute of Agricultural Development
in Transition Economies

Source: USDA

Variation wheat production

Source: Rosstat 2014

Wheat market policy interventions

IAMO
Leibniz Institute of Agricultural Development in Transition Economies

Source: Russian Grain Union, GTI

in RUB/t

in 1000 t

Export tax   Export ban

Wheat export   World market   Central   Black Earth

North Caucasus   Volga   Ural   West Siberia

Trade reversal

Source: IAMO

Research question & motivation

➢ **How well is the Russian wehat market functioning?**

  ➢Substantial interregional grain trade over large distances

  ➢Price shocks induced by regional harvest shortfalls need to be transmitted quickly and fully to other regions to induce wheat inflows

  ➢To mobilize additional grain export potential

Model approach

- **Spatial price transmission model framework**
  - Which factors determine market integration?
  - How export ban 2010/11 influenced domestic market integration in Russia?
- **Comparative study**
  - Corn market USA as a benchmark

Spatial market efficiency (I)

Basic definitions in price transmission theory

➢**Spatial price equilibrium**: prices in two spatially separate markets differ at most by trade costs (Takayama and Judge 1971)

➢**Trade arbitrage**: traders make use of price differences exceeding trade costs

Market A

Market B

Price A < price B

Spatial market efficiency (II)
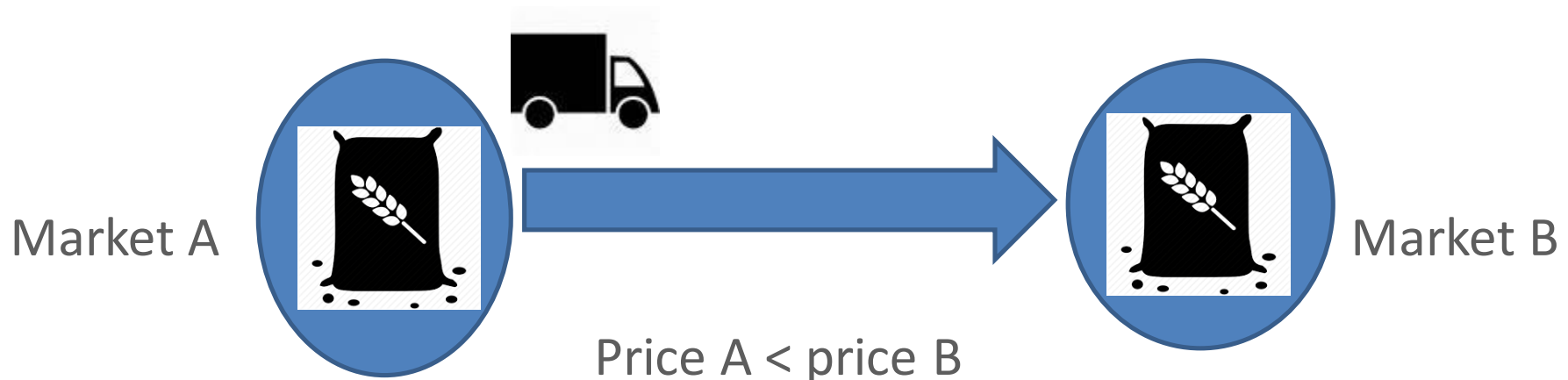
What is a well-functioning market?

- ➤ A spatially efficient market which is well integrated
- ➤ An integrated market is characterized by price co-movement and a spatial price equilibrium
- ➤ Deviations from the equilibrium are of a transitory nature and are quickly corrected e.g. by trade arbitrage
- ➤ Law of One Price holds, i.e. that the price difference is at most equal to trade costs

Compare: Fackler & Goodwin 2001

Literature

Spatial price transmission

➢**Grain markets Russia**
e.g. Götz et al. 2016, Renner et al. 2014, Perekhozhuk et al. 2015

➢**Food markets Russia**
e.g. Gardner & Brooks 1994; Goodwin, Grennes & McCurdy 1999

➢**Regional agricultural markets USA**
e.g. Goodwin & Piggott 2001; Goodwin & Schroeder 1990; 1991

Vector error correction model (I)

➢ **Long-run spatial price equilibrium**

$$\mathbf{P_{1t}} = \boldsymbol{\alpha} + \boldsymbol{\beta} * \mathbf{P_{2t}} + \boldsymbol{\varepsilon_t}$$ Deviations from the equilibrium

long-run price transmission elasticity

➢ **Vector error correction model** (Engle & Granger, 1987)

$$\Delta\mathbf{P}_t = \gamma * \varepsilon_{t-1} + \sum_{m=1}^{M} \Theta_m * \Delta\mathbf{P}_{t-\mathrm{m}} + \boldsymbol{\varepsilon}_t$$

Speed of adjustment parameter

Vector error correction model (II)

➢ **Threshold vector error correction model** (Greb et al., 2013)

$$\Delta P_t = \begin{cases} \rho_1 * \gamma^{'} P_{t-1} + \sum_{m=1}^{M} \Theta_{1m} \Delta P_{t-m} + \varepsilon_t \,, & if\ \gamma^{'} P_{t-1} \leq \tau_1\ (Lower) \\ \\ \rho_2 * \gamma^{'} P_{t-1} + \sum_{m=1}^{M} \Theta_{2m} \Delta P_{t-m} + \varepsilon_t, & if\ \tau_1 < \gamma^{'} P_{t-1} \leq \tau_2\ (Middle\ ) \\ \\ \rho_3 * \gamma^{'} P_{t-1} + \sum_{m=1}^{M} \Theta_{3m} \Delta P_{t-m} + \varepsilon_t \,, & if\ \tau_2 < \gamma^{'} P_{t-1}\ (Upper) \end{cases}$$

Speed of adjustment parameter

➢ All prices in logarithm

➢ Thresholds estimated by regularized Bayesian technique

➢ Other parameters estimated by restricted maximum likelihood

Determinants of market integration

Tobit model

$$\Psi_i = f(distance_i, trade\ volume_i, exporter_i, country_i)$$

|	
Ψ_i	Estimate of the long-run price transmission elasticity (β) for every market pair i
$distance_i$	Average railway distance (km) between every market pair i in Russia and the USA, weighted by volume
$trade\ volume_i$	Interregional trade volumes (t) between every market pair i in Russia and the USA, transported by train
$exporter_i$	$= \begin{cases} 1 & if & \text{a region from market pair } i \text{ is an exporter,} \\ 0 & & \text{otherwise.} \end{cases}$
$country_i$	$= \begin{cases} 1 & if & \text{market pair } i \text{ is in Russia,} \\ 0 & if & \text{market pair } i \text{ is in the USA.} \end{cases}$

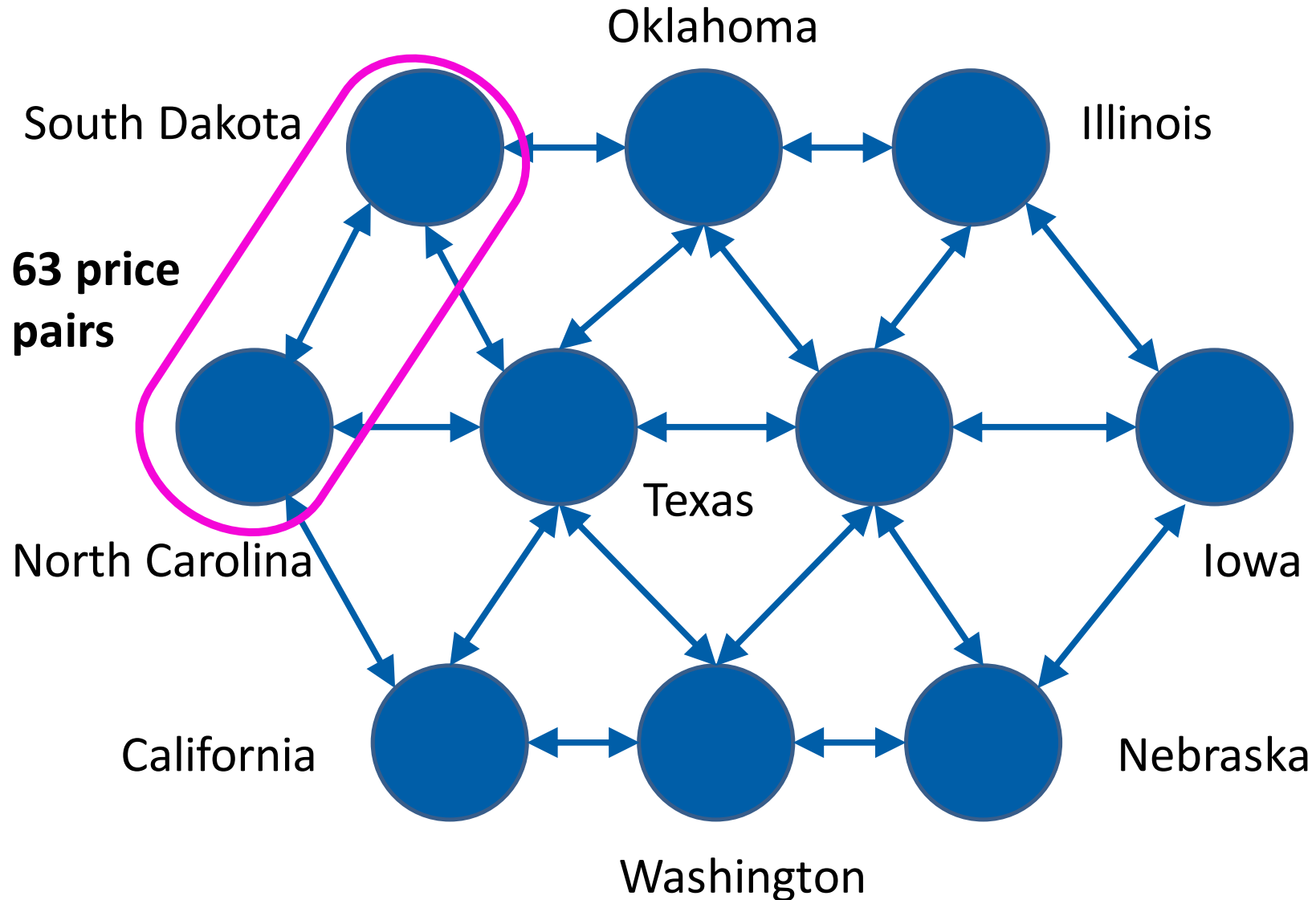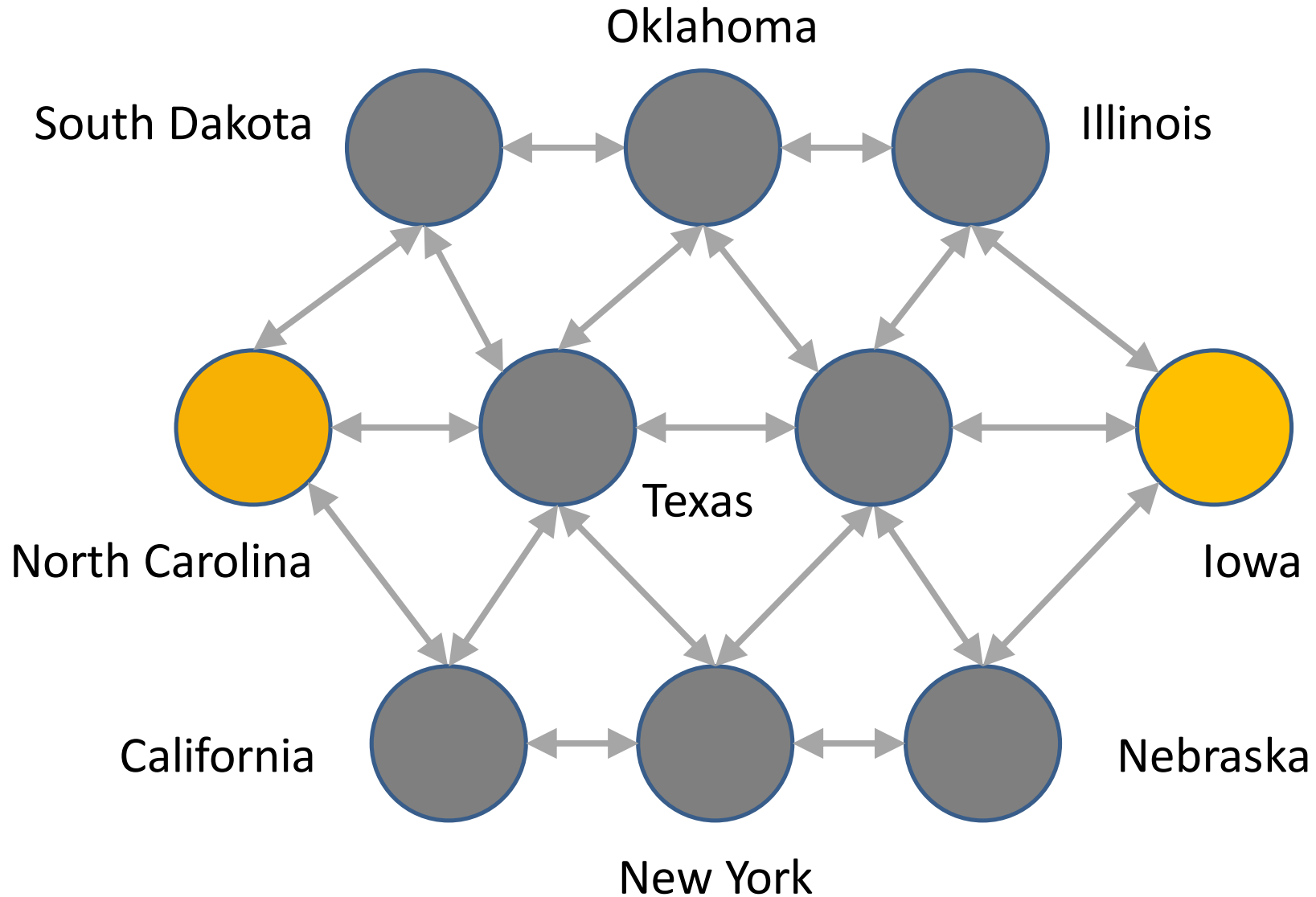# Aggregated analysis - Russia
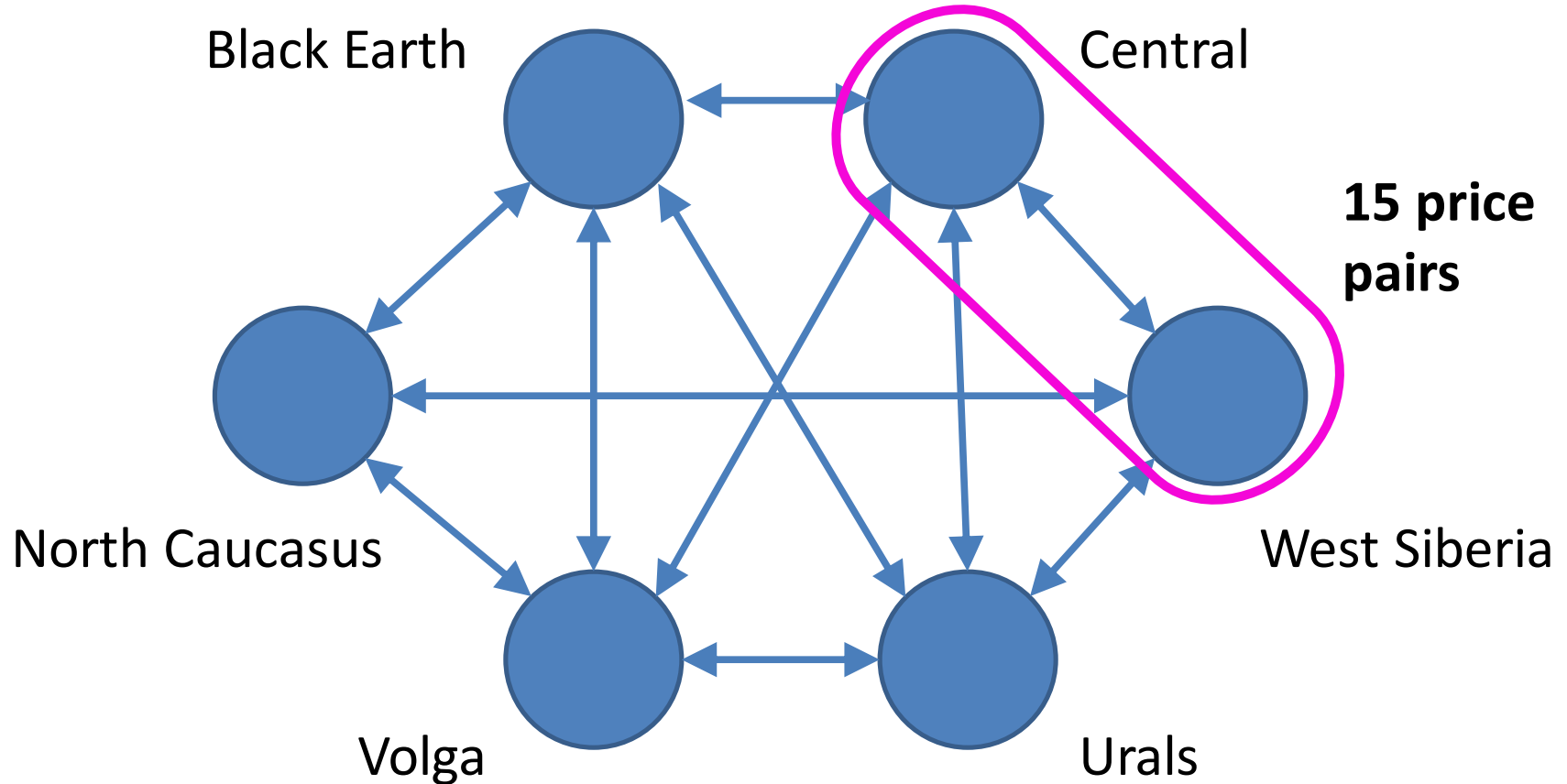
Aggregated analysis - Russia
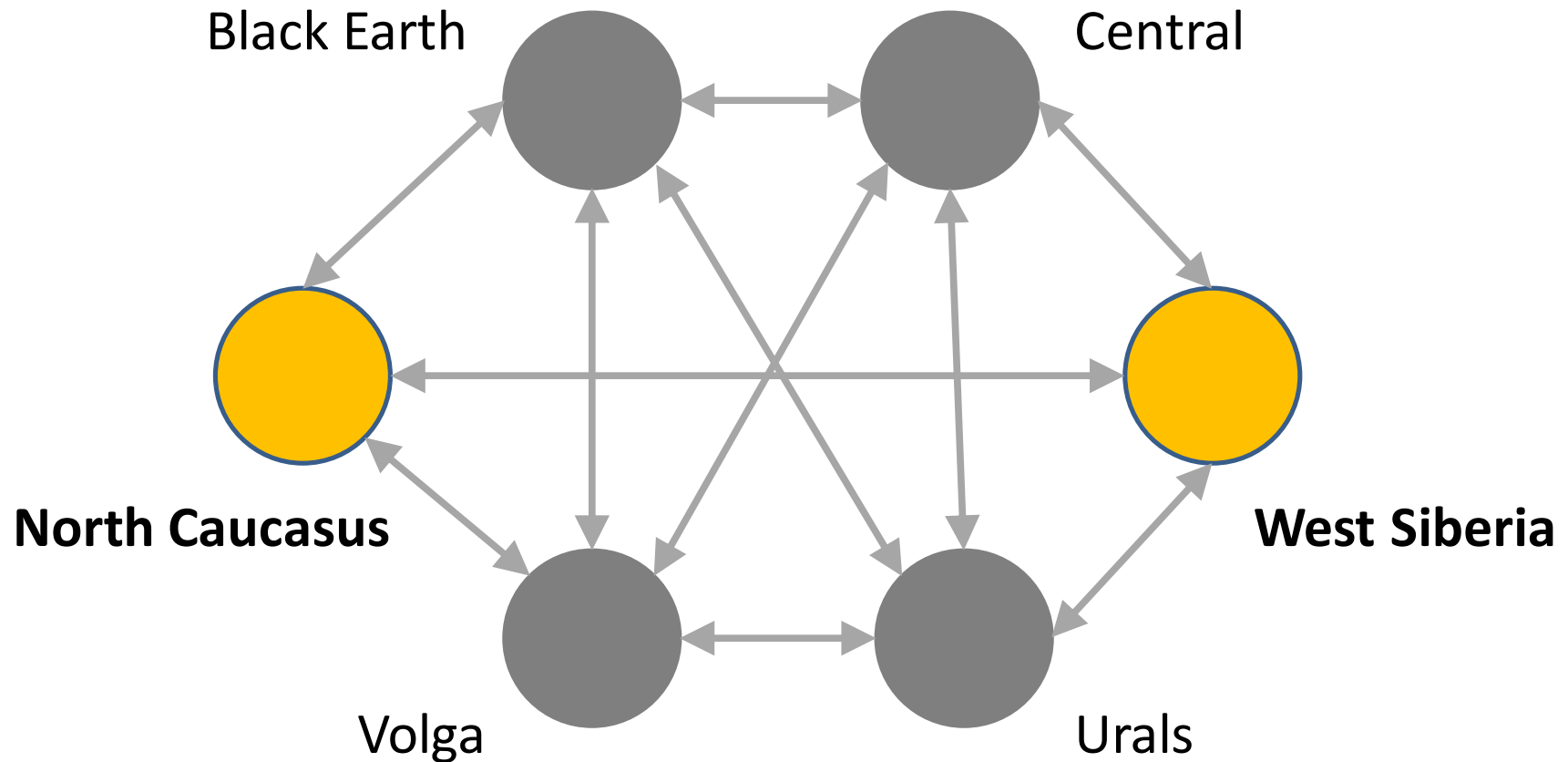
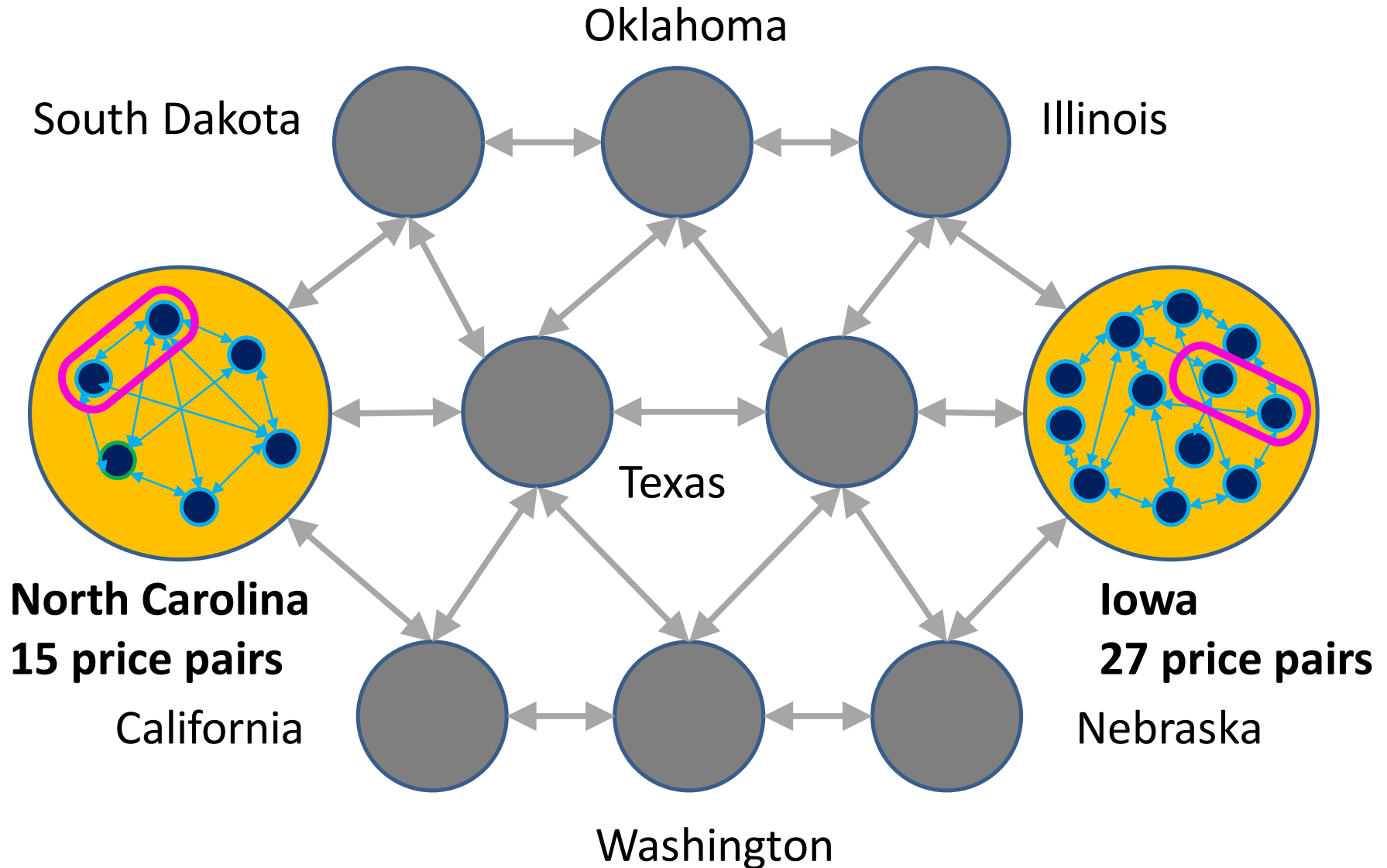# Disaggregated analysis - Russia
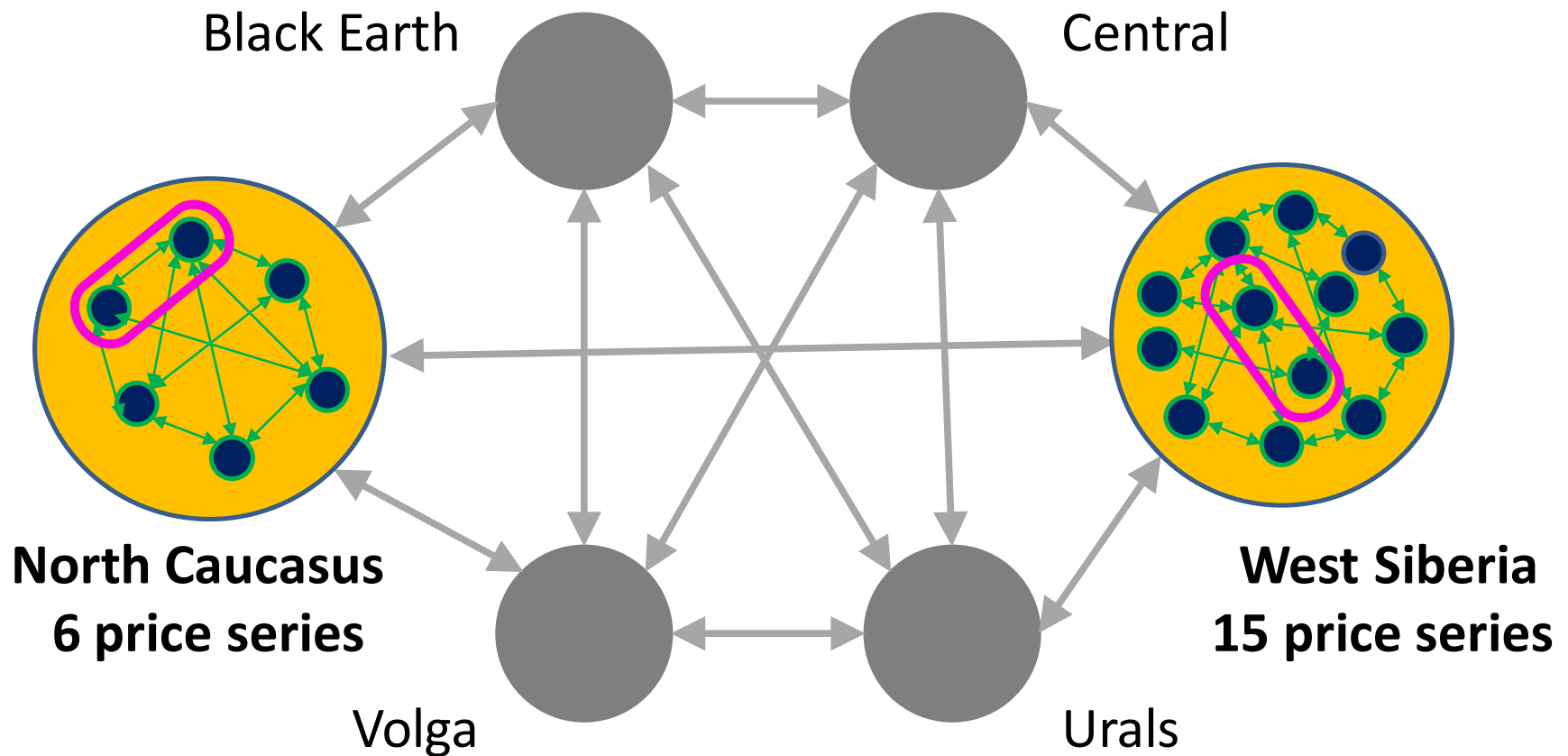
Aggregated analysis - USA

Aggregated analysis - USA

Disaggregated analysis - USA

Data properties

- ➢ Test on integration (ADF test)
- ➢ Test on linear cointegration (Johansen 1991)
- ➢ Test on threshold cointegration (Hansen & Seo 2002; Larsen 2012)

Results aggregated analysis

Source: IAMO

Market integration pattern

Regions	2009/10
Central - Black Earth	0.940
Central - Volga	0.698
Central - Urals	0.432
Central - West Siberia	0.358
North Caucasus - Central	0.346
North Caucasus - Black Earth	0.333
North Caucasus - Volga	0.267
North Caucasus - Urals	0.156
North Caucasus - West Siberia	0.132
Black Earth - Volga	0.740
Black Earth - Urals	0.469
Black Earth - West Siberia	0.388
Volga - Urals	0.677
Volga - West Siberia	0.571
Urals - West Siberia	0.833

URALS   CENTRAL BLACK E

WEST SIBERIA   CENTRAL
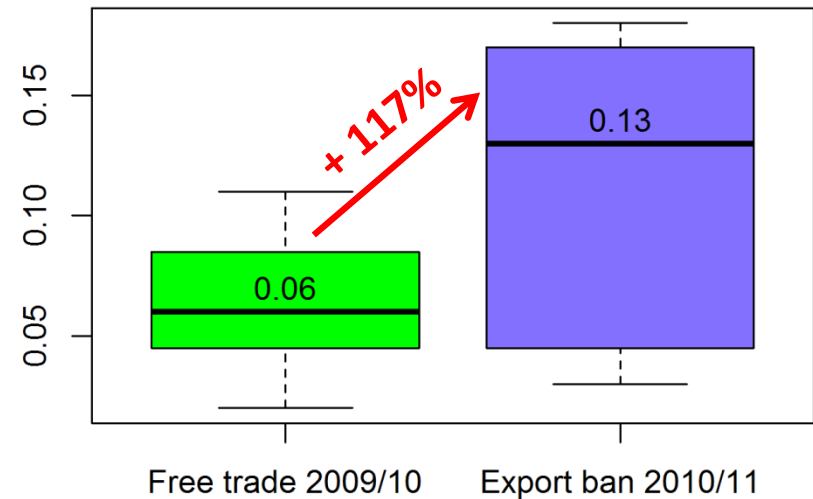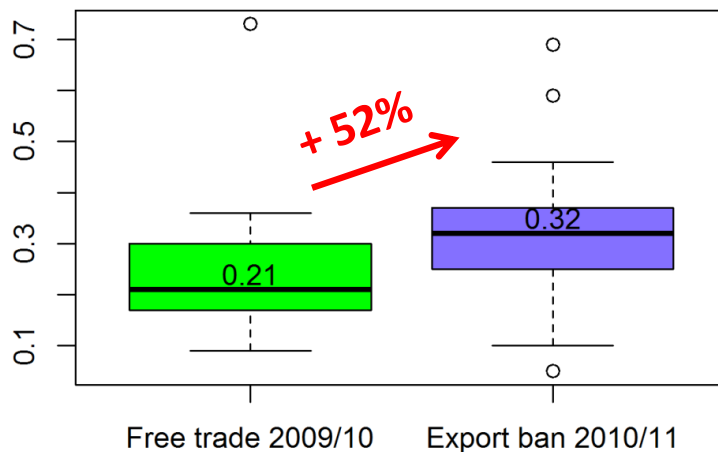
VOLGA

NORTH CAUCASUS
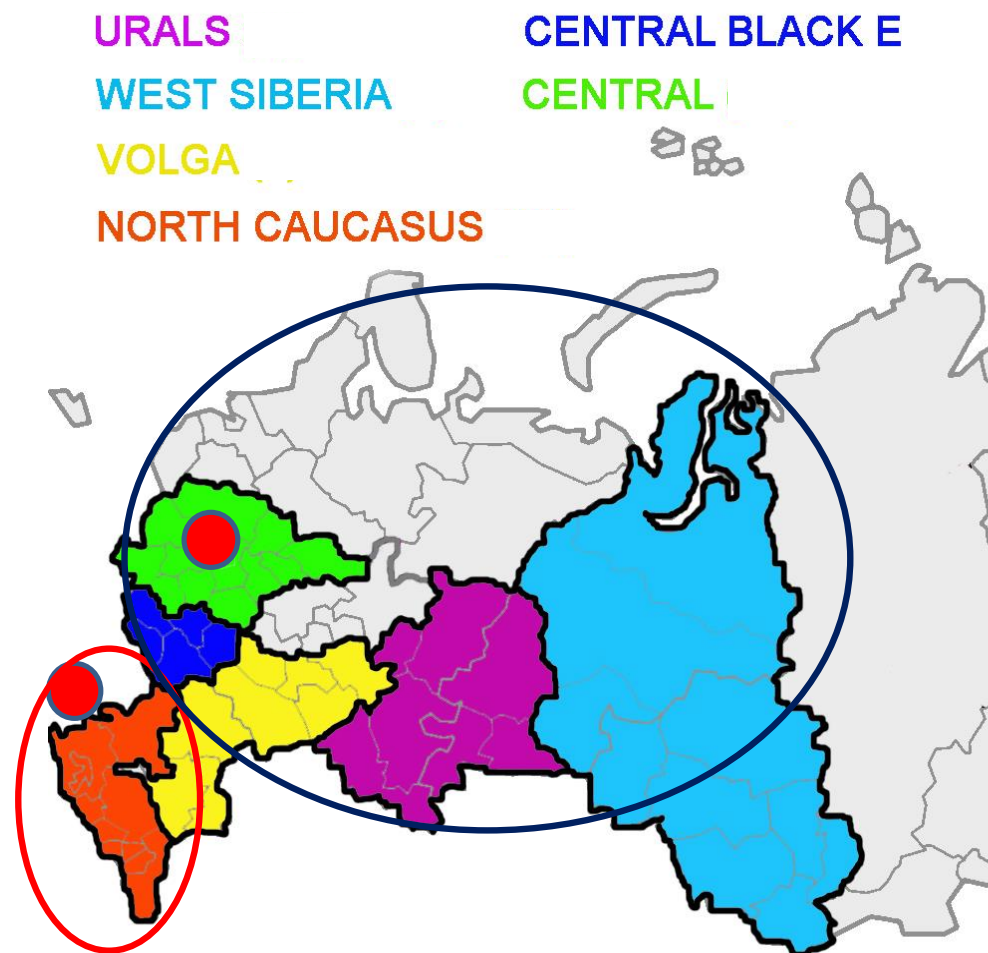
Export ban 2010/11

Long-run price transmission elasticity
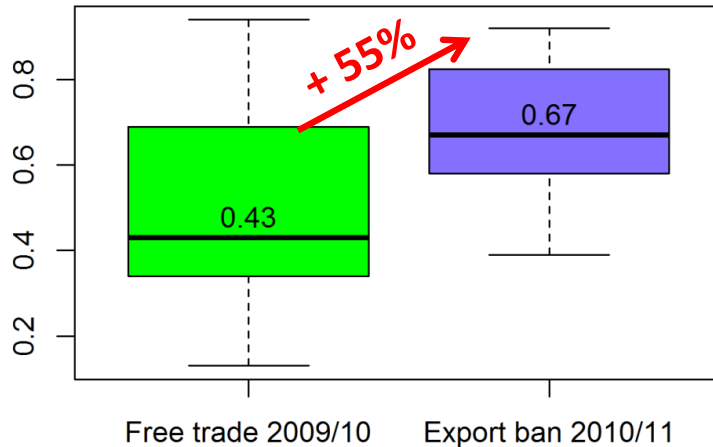
Total speed of adjustment

Band of Inaction

Increased business risk
- New destinations
- High level of fraud
- Enforcement of new contracts

Increased trade costs (10%)

Determinants of market integration

Tobit model

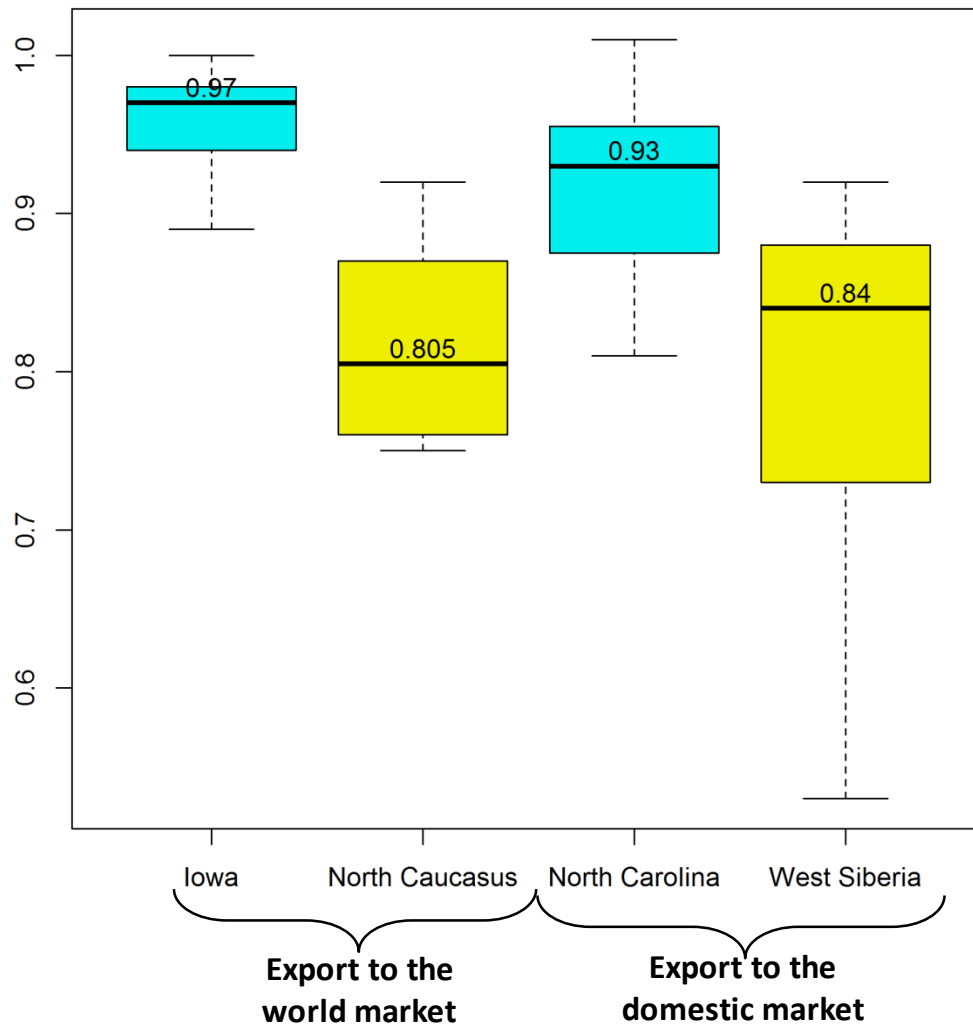| Dependent variable: Long-run price transmission elasticity	Russia	USA
Explanatory variables:	**Coefficient [Standard error]**	**Coefficient [Standard error]**
Traded volume *100 000 t*	0.032*** [0.007]	-0.001 [0.001]
Distance *100 km*	-0.014*** [0.003]	-0.010*** [0.001]
Exporter *To the world markets*	-0.363*** [0.040]	0.073*** [0.015]
Constant *Country effects*	0.826*** [0.062]	0.999*** [0.016]
Observations	78	
F-test (8, 70)	3486.54*** (Prob > F = 0.000)	

Results disaggregated analysis

Source: IAMO

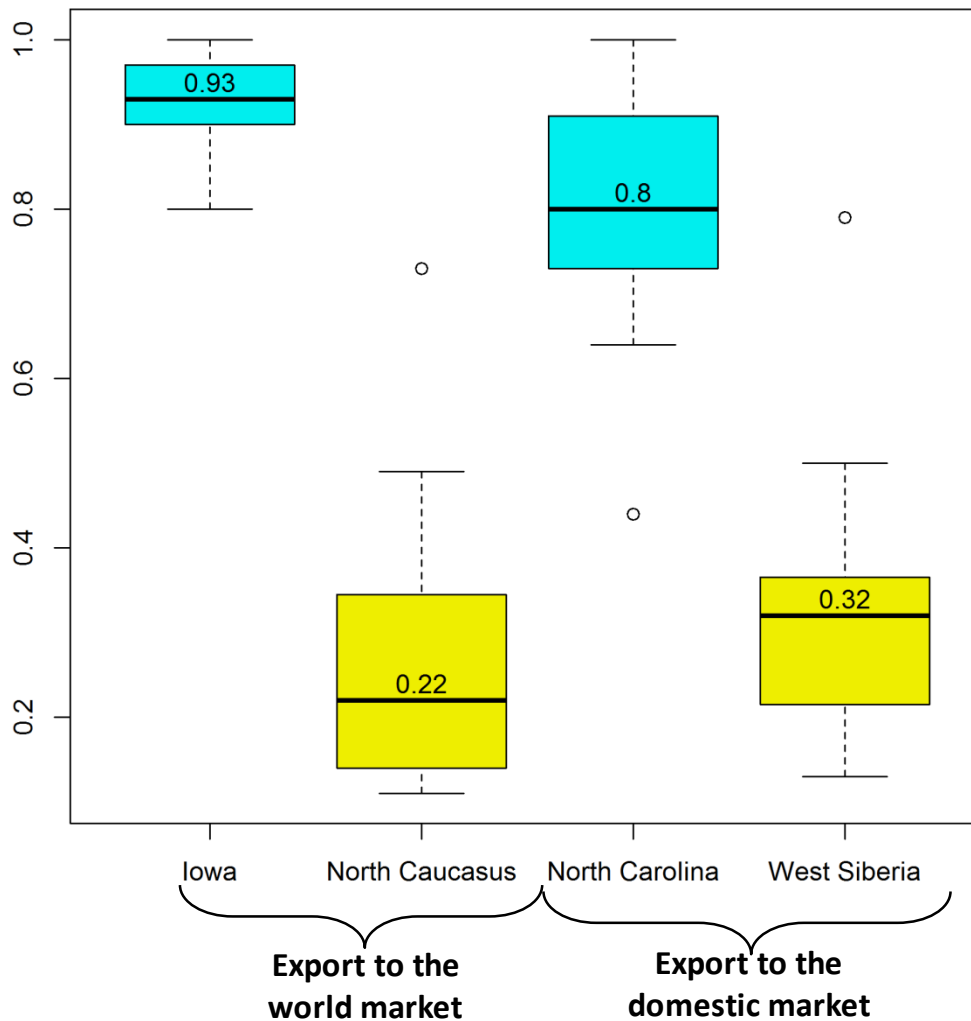# Country comparison (I)

Long-run price transmission parameter

> typically lower & more heterogeneous in Russia

USA (cyan)

Russia (yellow)

Box plot values: Iowa 0.97, North Caucasus 0.805, North Carolina 0.93, West Siberia 0.84

Iowa | North Caucasus | North Carolina | West Siberia

Export to the world market | Export to the domestic market
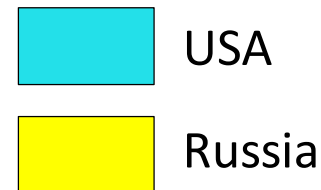
Country comparison (II)

Total speed of adjustment

Country comparison (III)

Thresholds (band of inaction)
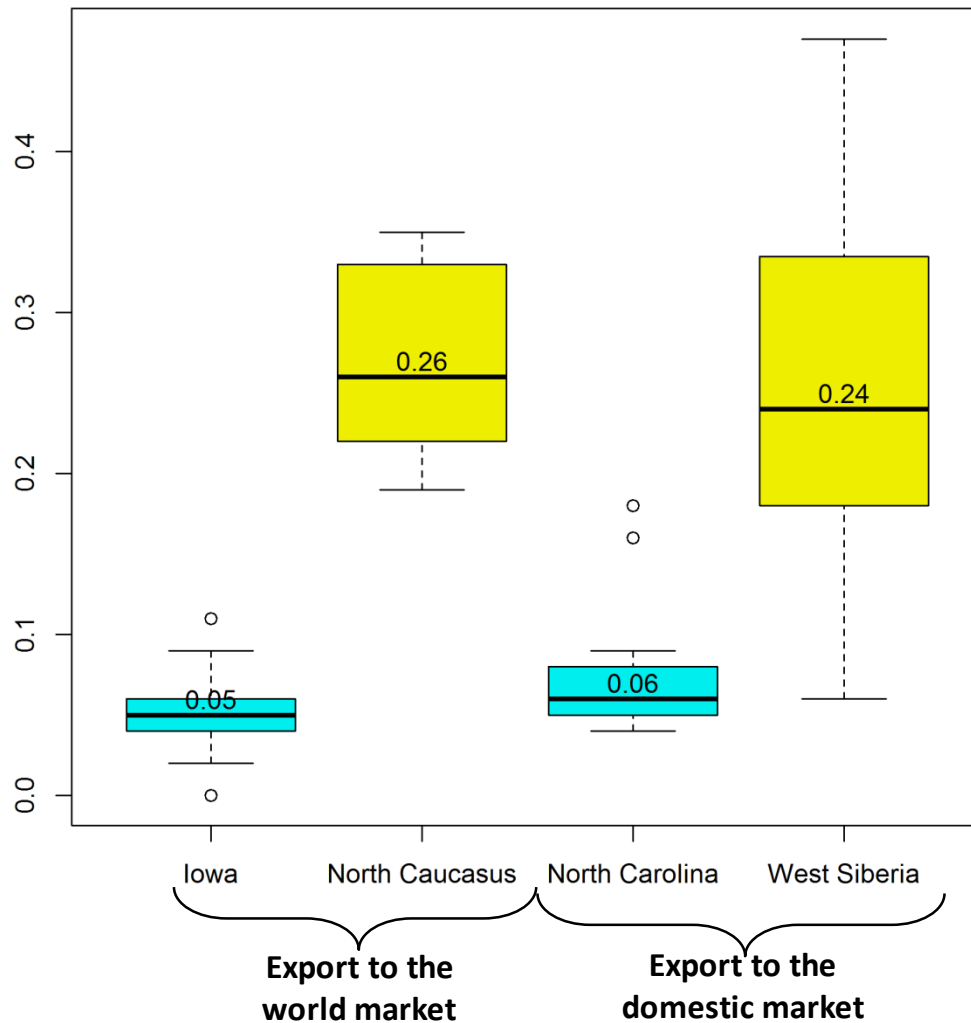
➤ 5 times higher in Russia

Summary & conclusions

➢ Spatial wheat market efficiency in Russia relatively low compared to the USA

  ➢ physical trade flows drive market integration in Russia, information flows important in the USA

  ➢ Influence of distance stronger in Russia

  ➢ Export region separated from domestic market in Russia, whereas strongly integrated in the USA

➢ Wheat market USA more homogeneously integrated

➢ Export ban 2010/11

  ➢ Market integration +50%

  ➢ Price adjustments +50%

  ➢ Transaction costs doubled

Policy recommendations

- Upgrade grain trade infrastructure (information system, transport facilities) in Russia
  - Investments by the government
  - Attract private investments
- Strengthen integration of the domestic regions with the exporting region
- Spatially restructure the wheat supply chain
  - Reduce grain trade over large distances
  - Governmental subsidization of the livestock sector should be focused regionally

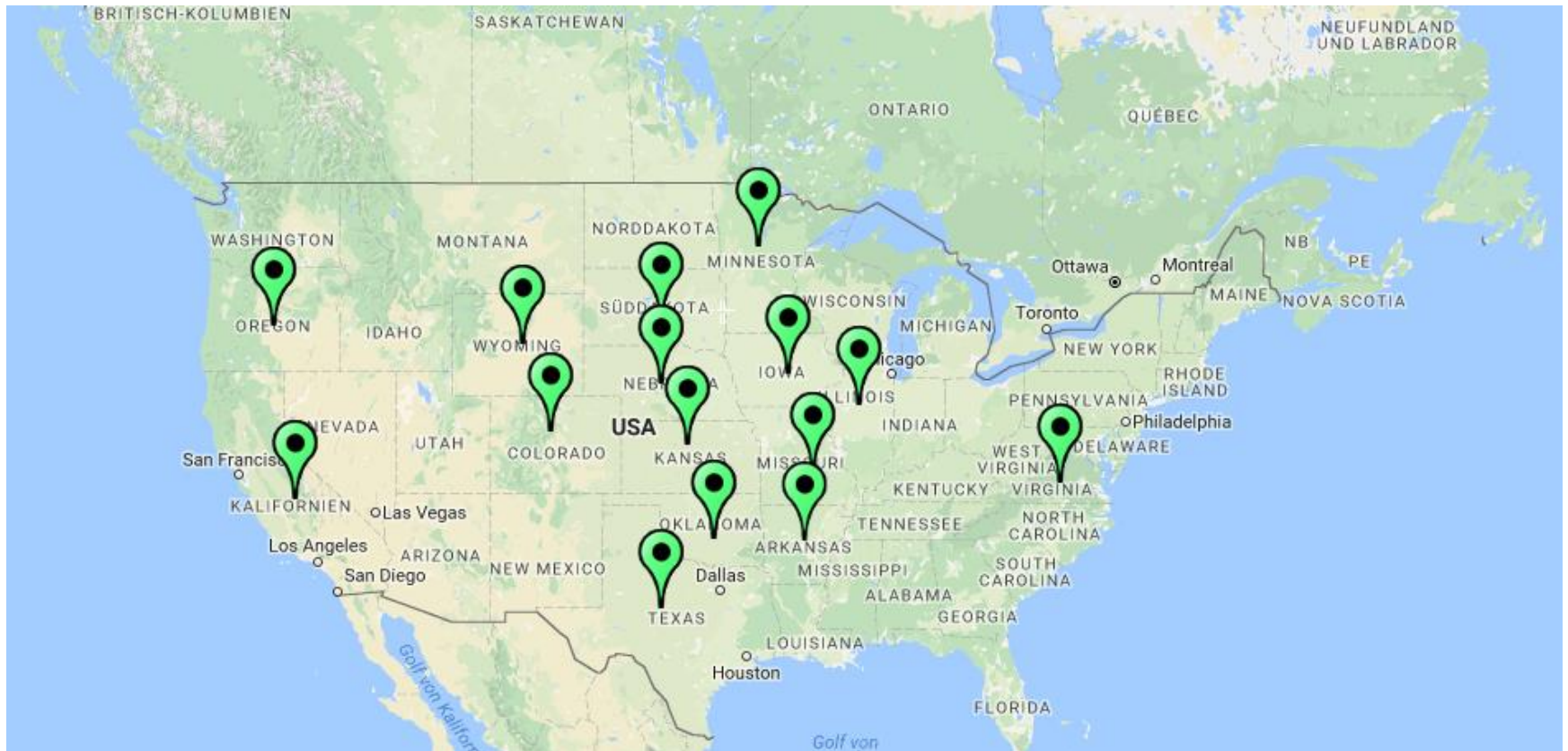**Thank you very much
for your attention!**
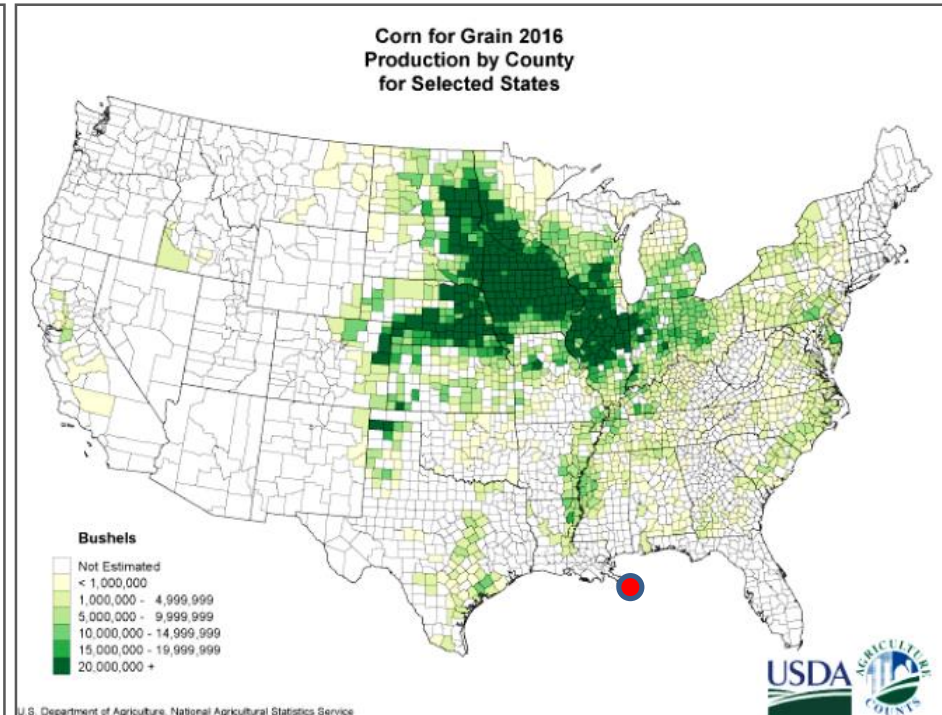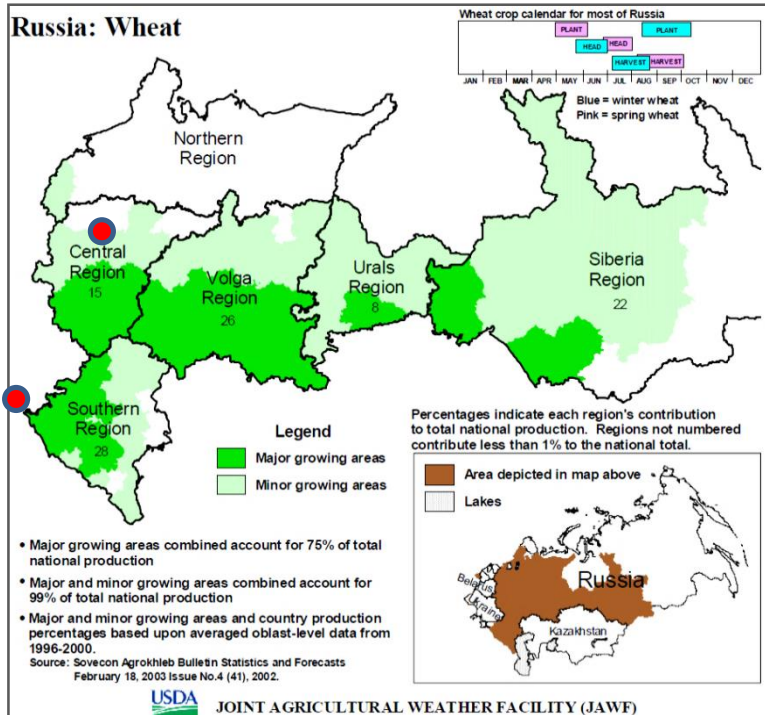
Aggregated level analysis
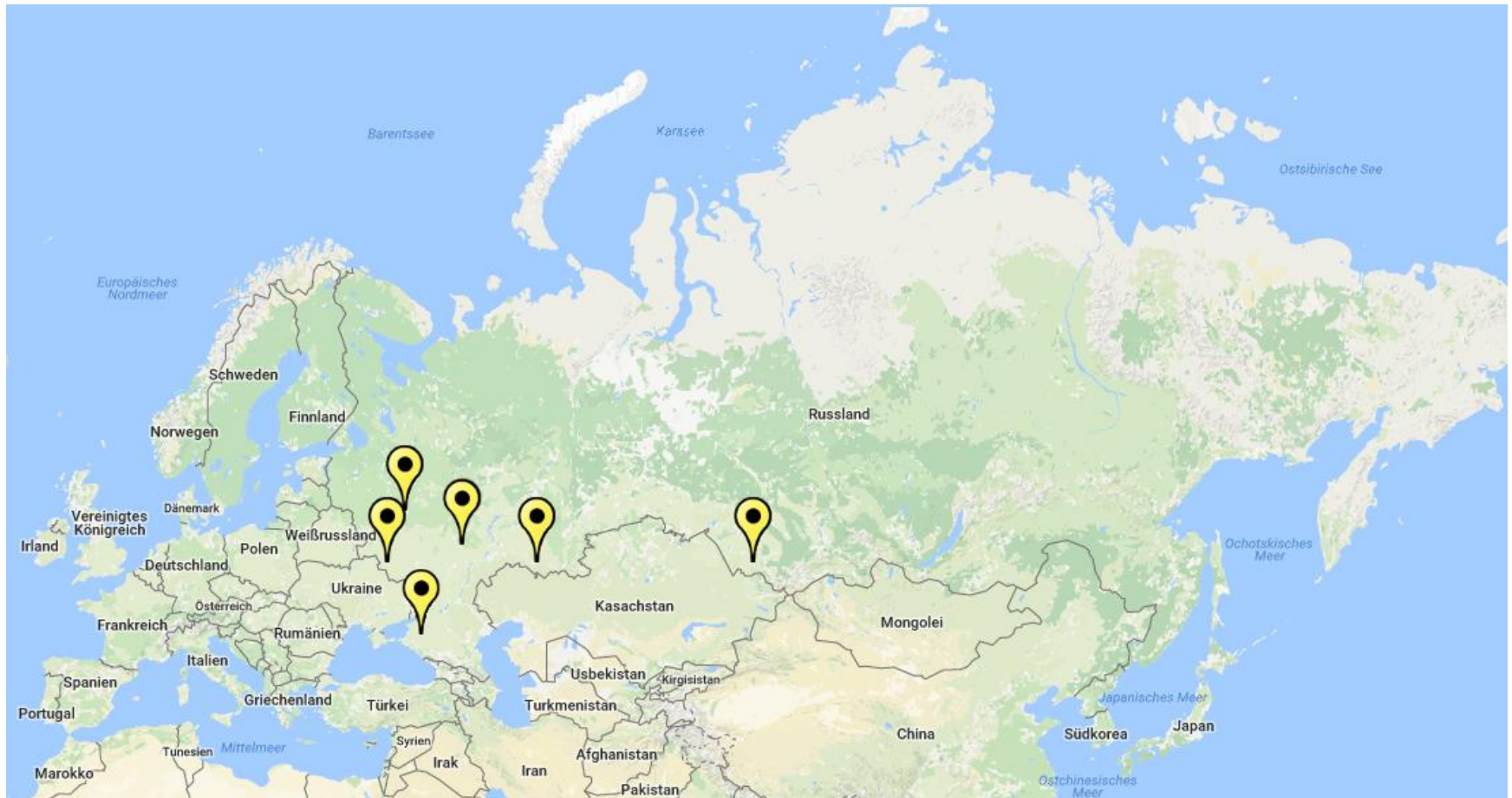
Source: google maps

Aggregated level analysis

Source: google maps

Grain production Russia and USA

Grain markets characteristics Russia and USA

	Russia Wheat	USA Corn
Large exporter	TOP5	№1
Domestic use	c.a. 70% • Feed • Food	c.a. 85% • Feed • Food • Ethanol
Regional production	Scattered	Concentrated
Domestic trade distances	Large (up to 3000 km)	Short (up to 500 km)
Transport infrastructure	Defficient	Efficient
Transportation modes	Truck, < 500 km Rail, > 1000 km Barge, N/A	Truck, < 500 km Rail, > 1000 km Barge, > 1000 km
Futures market	Minor importance	Well-developed