Bundesministerium für Ernährung und Landwirtschaft

STARLAP

Bundesanstalt für Landwirtschaft und Ernährung

Russia's agricultural import substitution policy: Price volatility effects on the pork supply chain

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Eurasian Food Economy

Characteristics agri-food sector Russia

- Agricultural land >200 million ha
- Large black soil areas (50% of global resources)
- Good climatic conditions (rainfall)
- Population 144 million
- Until 2014 one of the largest food importers in the world
- Imports accounted for 40% of Russia‘s food consumption

Agricultural production regions

Source: IAMO

Agricultural import substitution policy

Aims

Food Sector Development
→Self-sufficiency
→ Food exporter

Agricultural import substitution policy

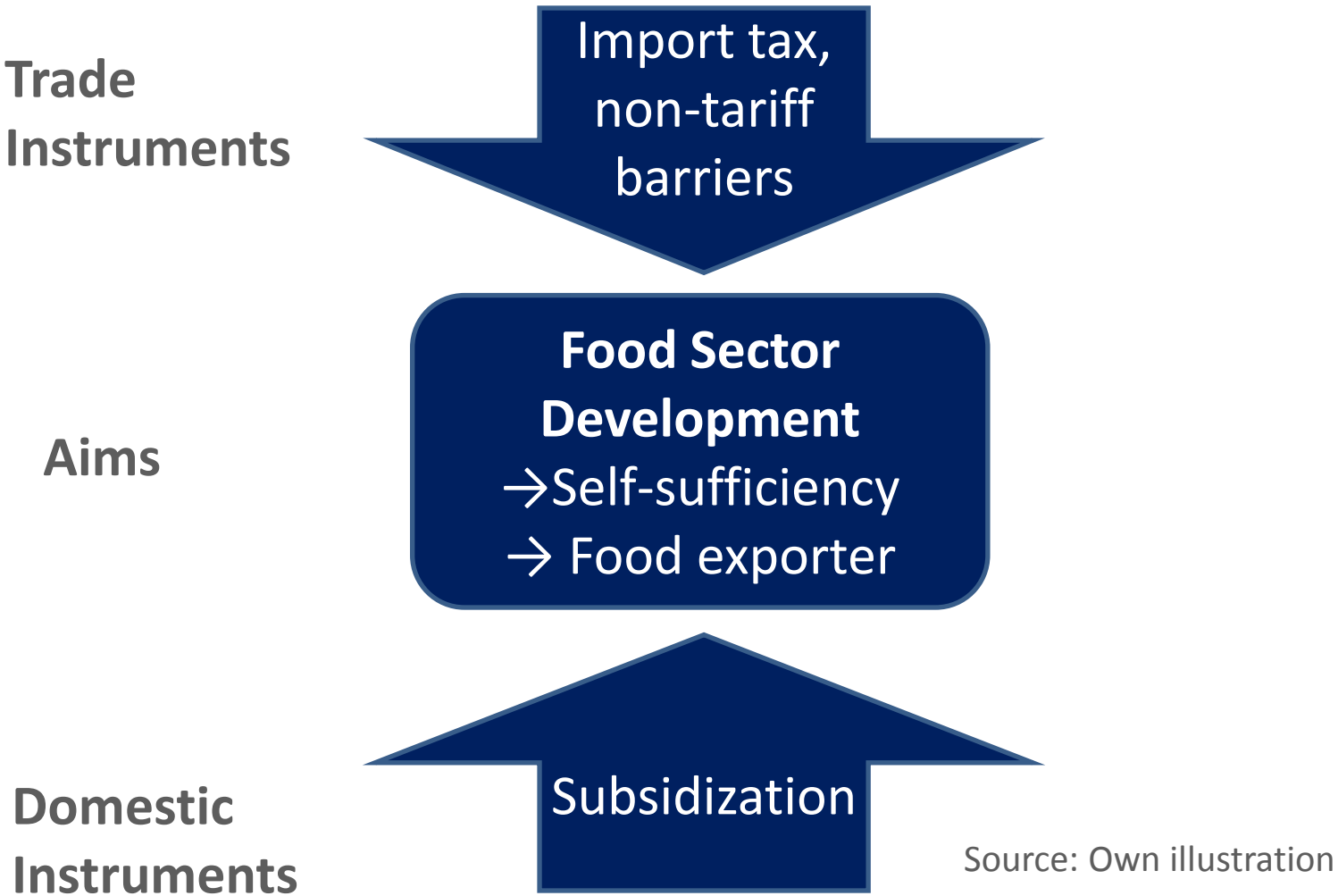
Trade Instruments

Import tax, non-tariff barriers

Aims

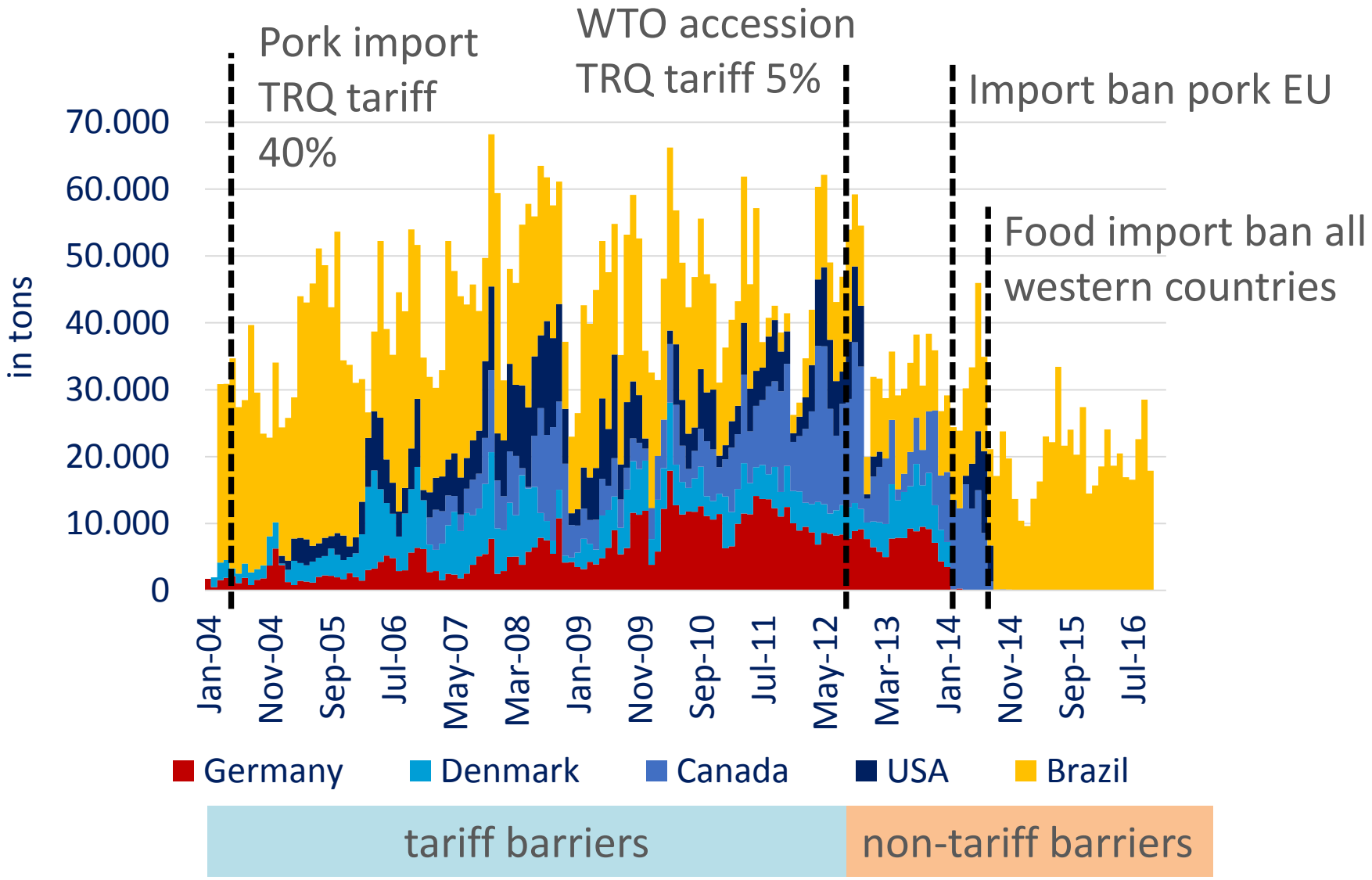
Food Sector Development
→Self-sufficiency
→ Food exporter

Agricultural import substitution policy



Source: Own illustration

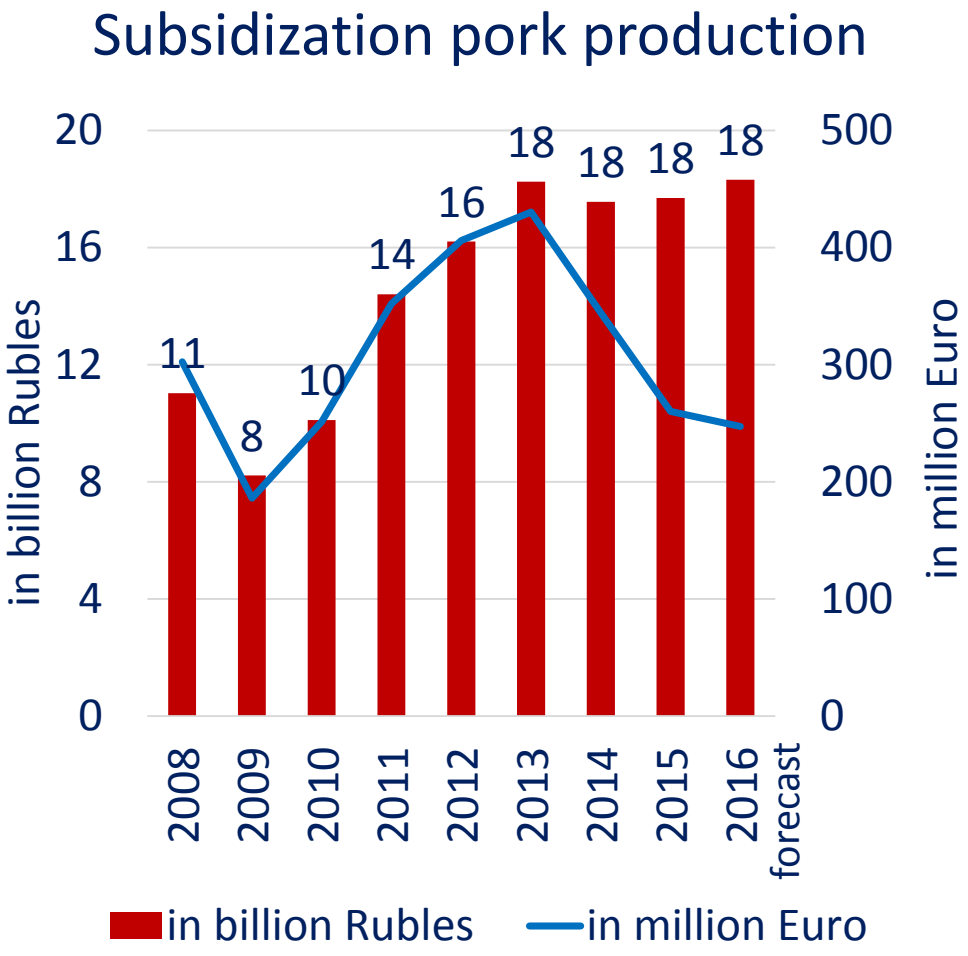
Russia‘s pork imports



Data Source: Rosstat, IHS 2016

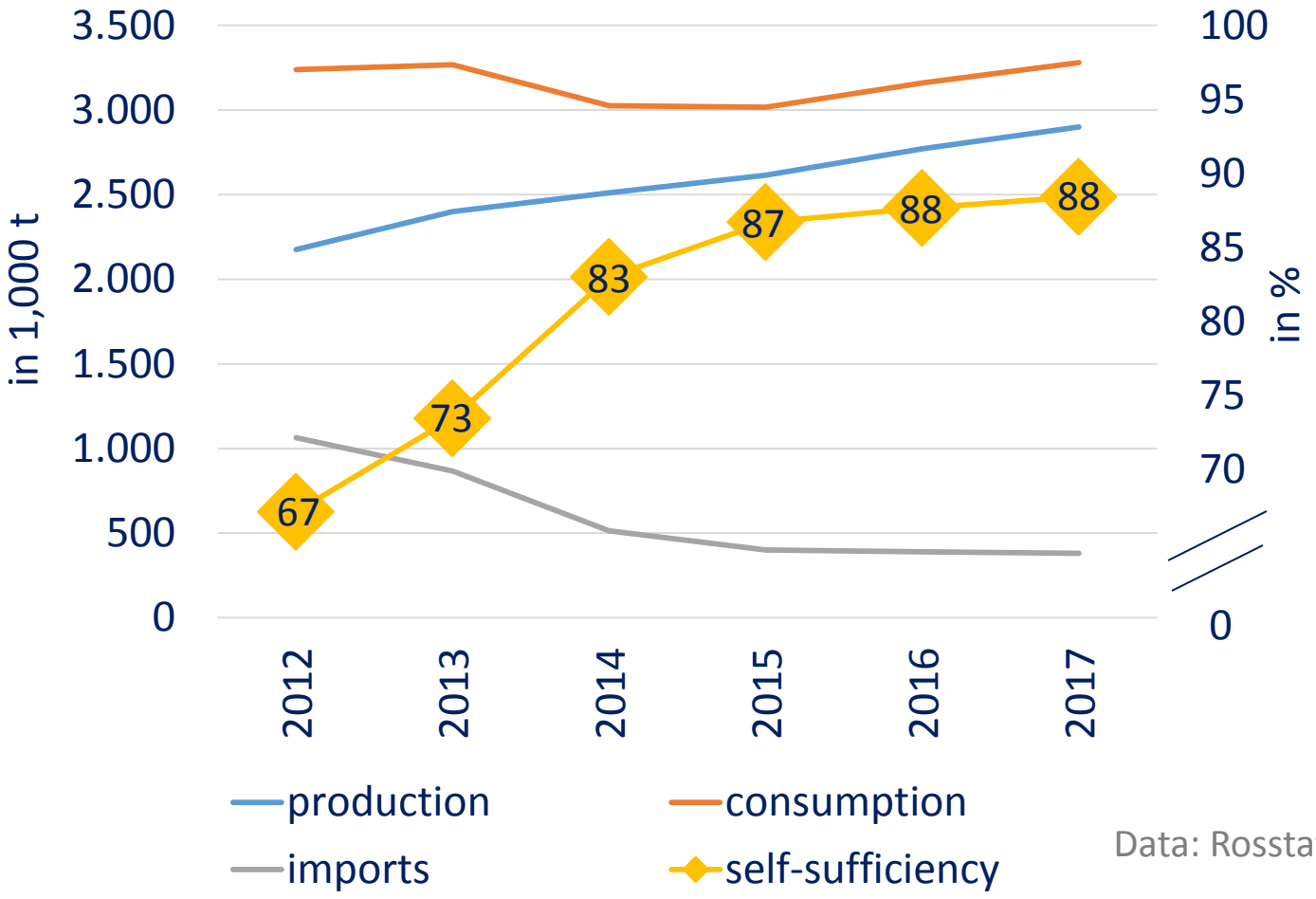
Subsidization agriculture

- National Priority Project 2006
- Agricultural Development Program 2008-2012
- Food Security Doctrine 2010
- Agricultural Development Plan 2013-2020
- Amendment to the Agric. Dev. Plan in 2014



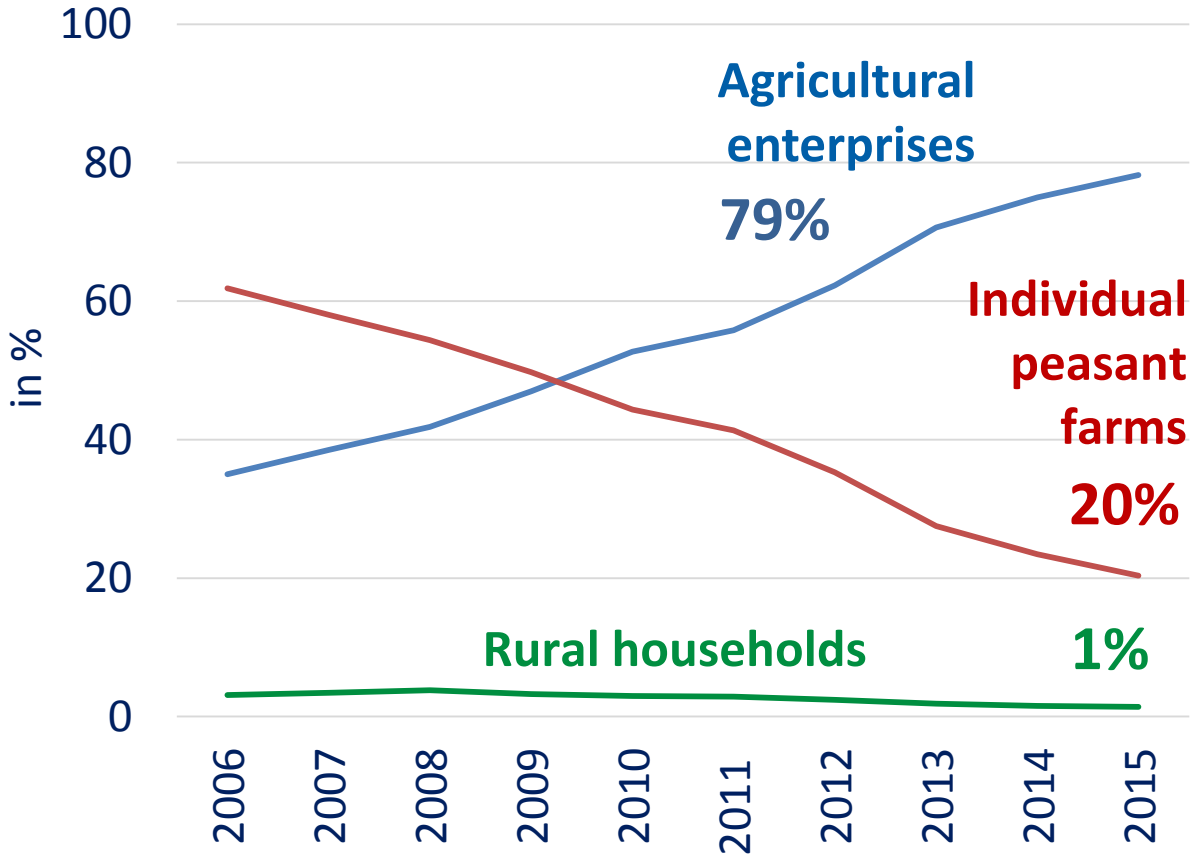
Data: National Union of Pork Production 2016

Development Russia‘s self-sufficiency pork



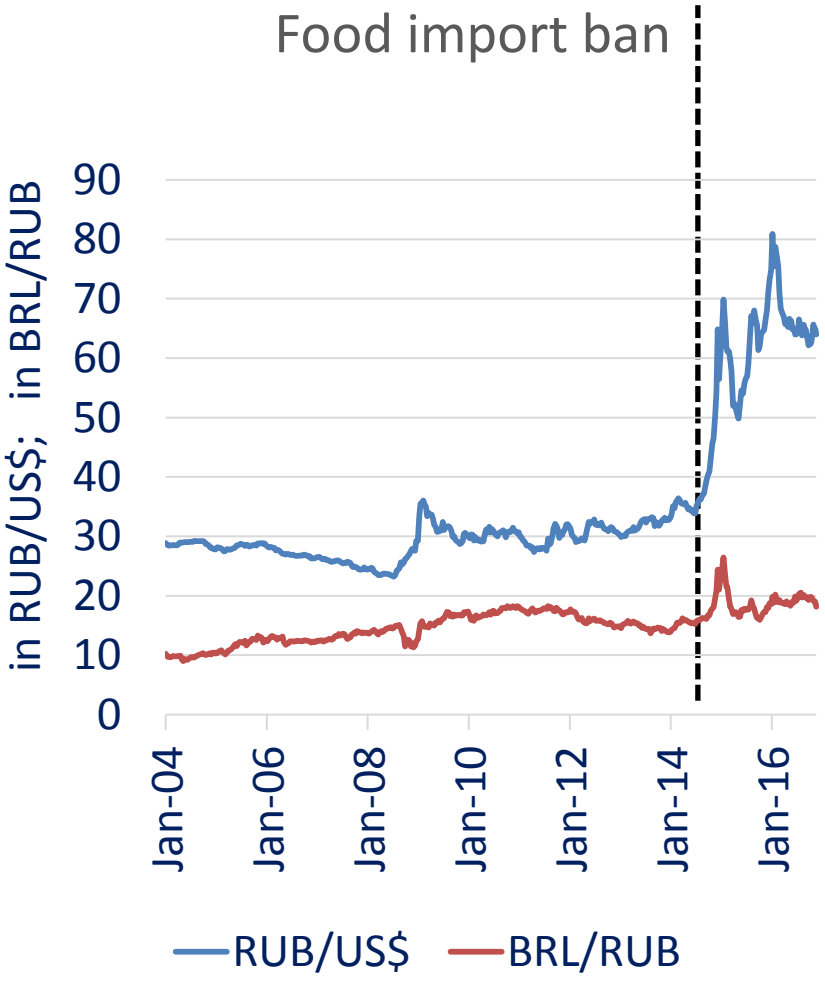
Data: Rosstat 2016

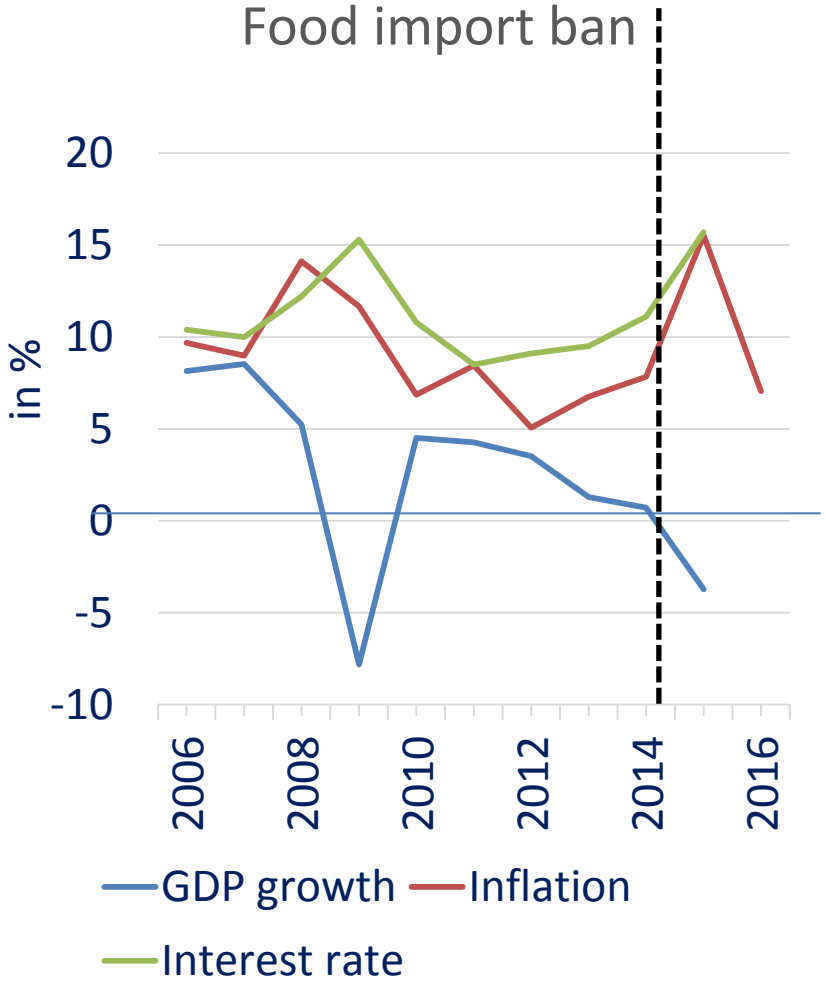
Structural change in Russia‘s pork sector



Feed production → Swine production → Slaught. & processing → Distribution consumers

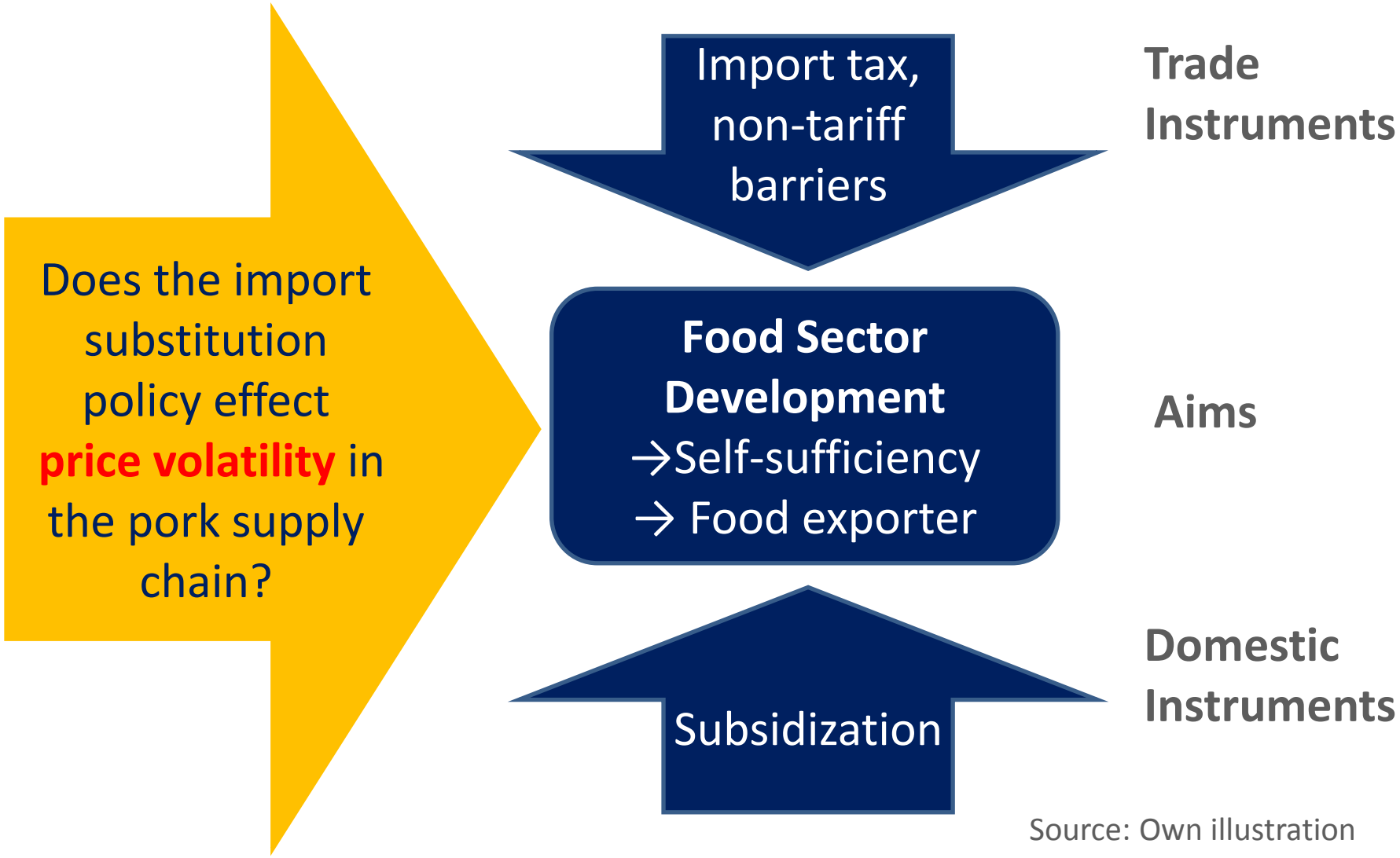
Macroeconomic developments





Data: Oanda

Research question



Source: Own illustration

Research hypothesis

Due to the **disintegration** of Russia‘s pork market from the world market, pork price volatility has increased:

- Elasticity of domestic pork supply↓
- Price effects of local shocks↑

Research hypothesis

Factors influencing the pork supply elasticity in Russia

- Size pork imports (↓)
- Number pork traders exporting to Russia (↓)
- Transport duration (↑) since share Brazil (↑)
- Subsidization of pork production (↑)

Research hypothesis

Domestic factors which may cause local pork market shocks in Russia:

- Veterinarian risk: African Swine Fever outbreaks
- Increase in domestic pork production
- Structural change in pork production

External factors

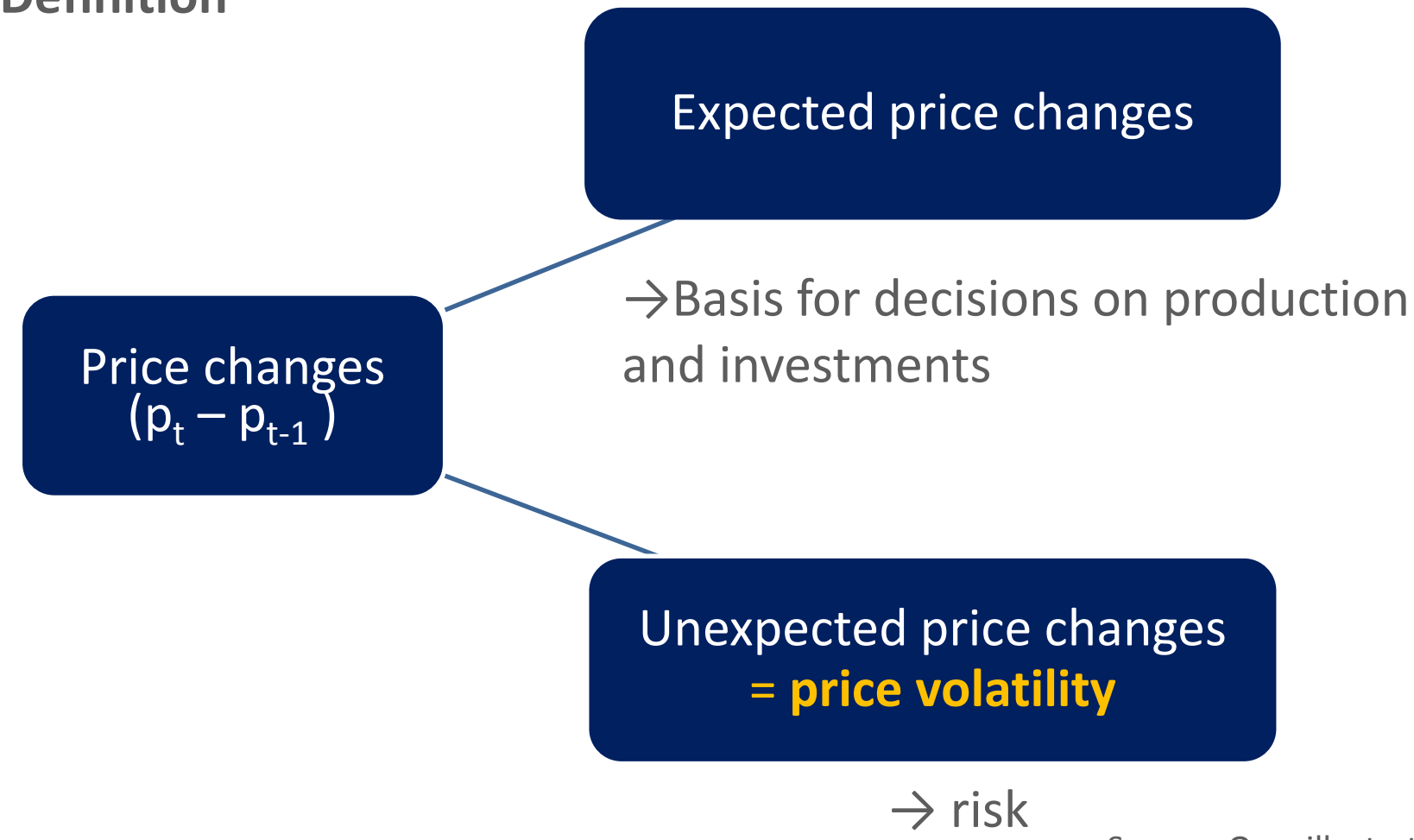
- Full ship pork imports (up to 8000t)
- Exchange rate changes
- Pork import price volatility

Literature

- Trade integration & price volatility
  e.g. Jacks, O'Rourke, Williamson 2011
- Price volatility transmission in the food supply chain
  Assefa et al. 2013, Rezitis & Stavropoulos 2011, Rezitis 2003
- Governmental policy interventions & price volatility
  An et al. 2016, Götz et al. 2013, Rude & An 2015

Price volatility & risk

Definition



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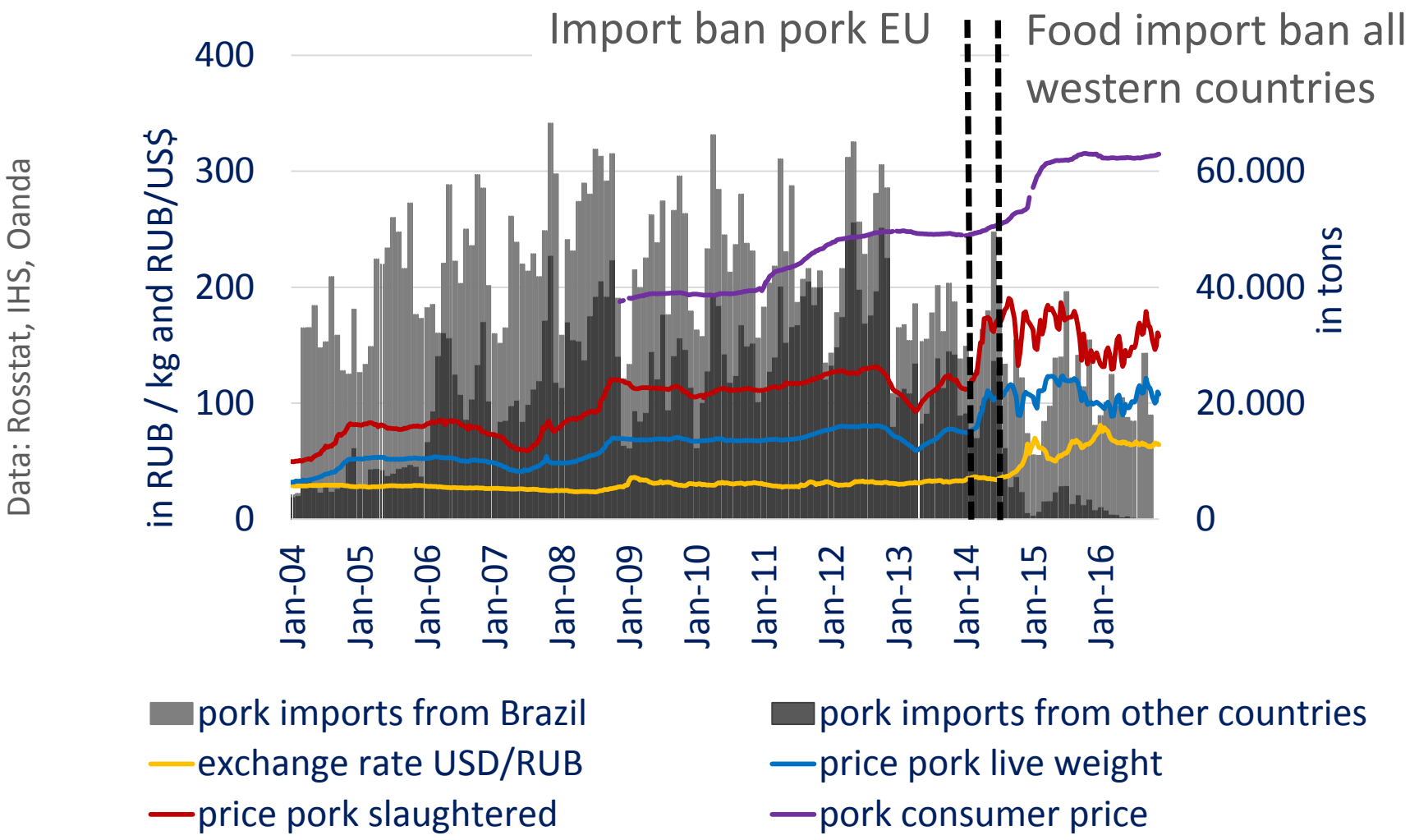
Price developments pork supply chain



Data: Rosstat, IHS, Oanda

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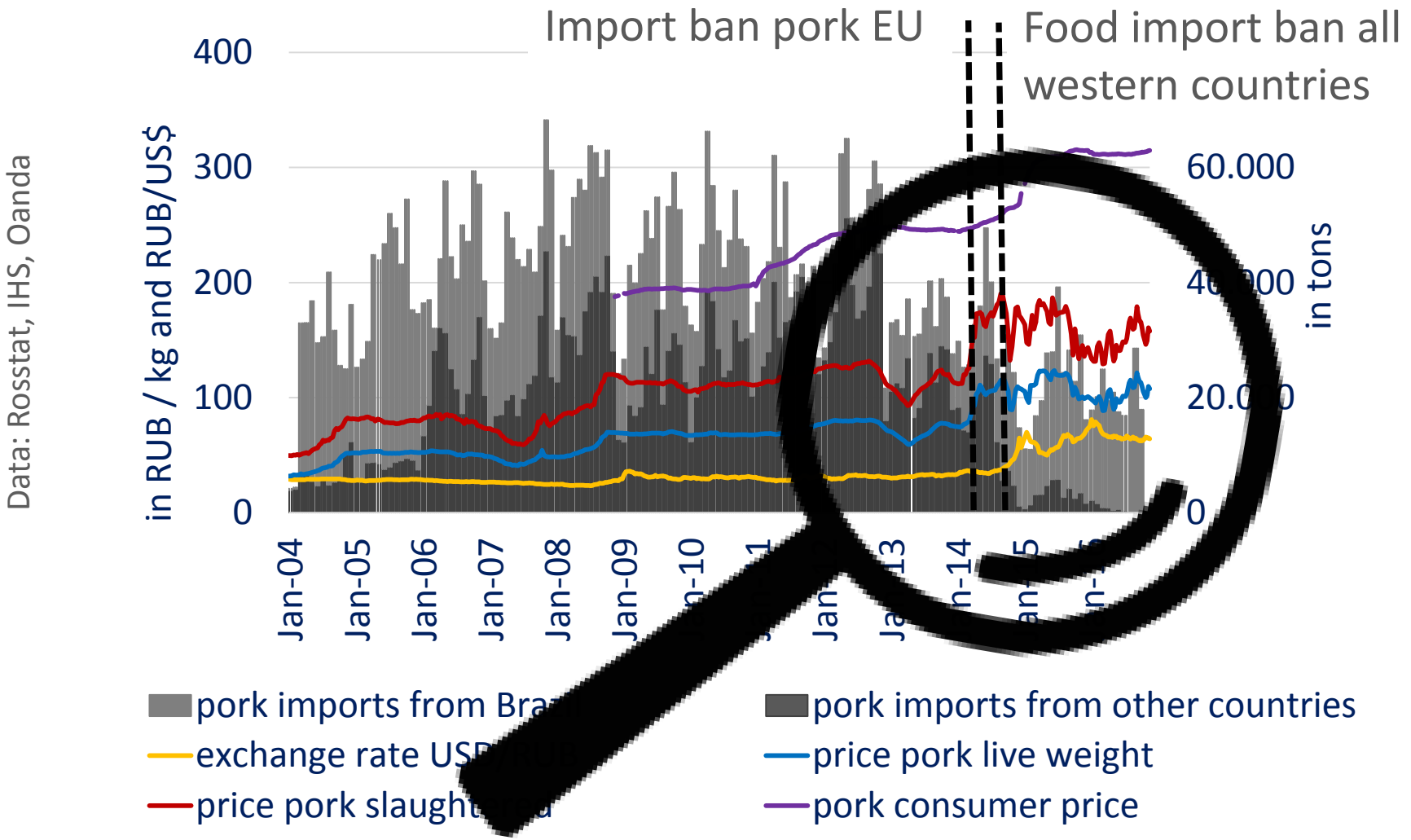

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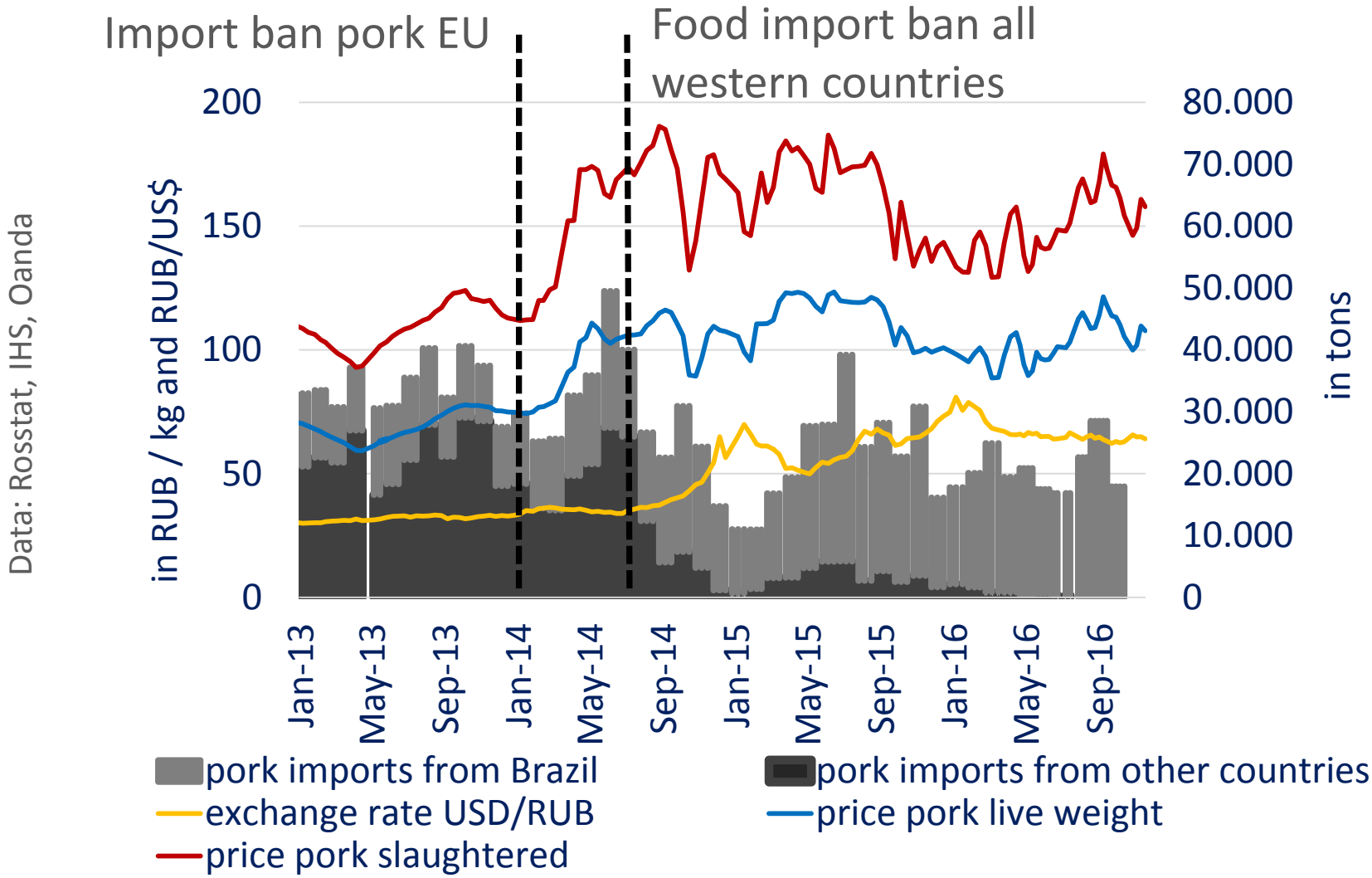
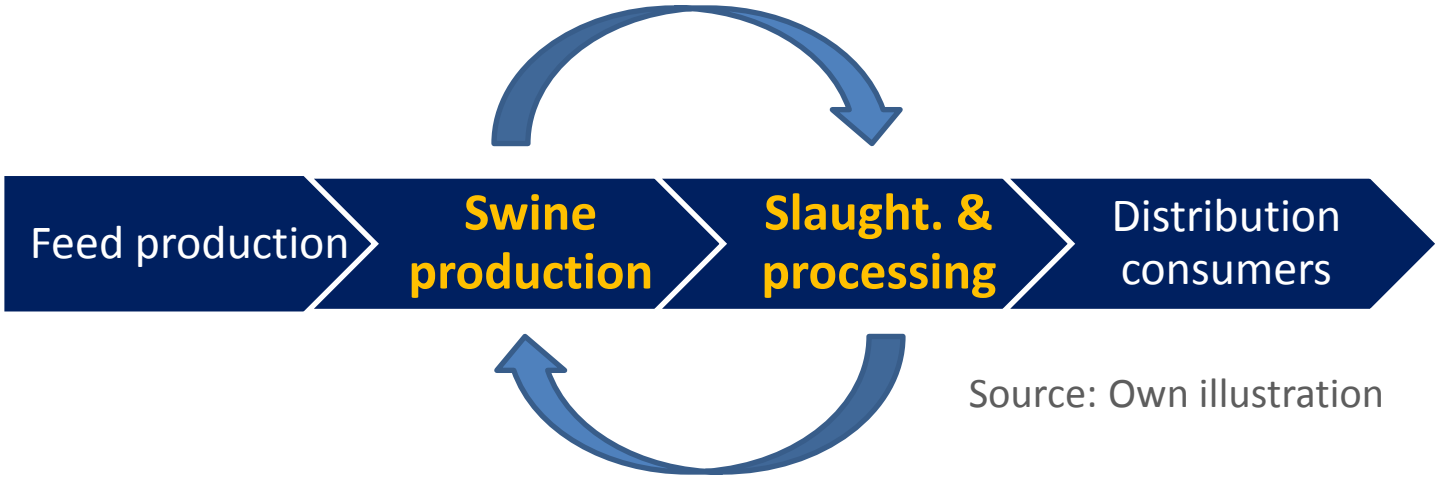


Data: Rosstat, IHS, Oanda

Methodological approach & model choice

- DCC-MGARCH (Engle, 2002)
  - Price volatility dynamics
  - Price volatility relationships



Source: Own illustration

Data

- 468 observations for
  - slaughtered pork prices
  - live weight pork prices
  - pork import price
  - US$-Ruble exchange rate
  - share pork imports from Brazil in total pork imports of Russia
- January 2004 – December 2016

Estimation strategy DCC-MGARCH

- Price series, exchange rates, import share Brazil are transformed to returns $r_{it} = \ln(\frac{p_{it}}{p_{it-1}})$ = actual relative price change

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$$r_{it} = \gamma_{0i} + \sum_{m=1}^{p} \gamma_{1im}\, r_{it-m} + \sum_{n=1}^{q} \gamma_{2in}\, z_{it-n} + \varepsilon_{it}$$

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- ε_{it} defined as $\varepsilon_{it} = \sqrt{h_{it}}\, z_{it}$ with

$$h_{it} = \delta_i + \underbrace{\alpha_i \varepsilon_{it-1}^2}_{\substack{\text{susceptibility} \\ \text{to shocks}}} + \underbrace{\beta_i h_{it-1}}_{\substack{\text{volatility} \\ \text{persistence}}}$$

= conditional variance

univariate GARCH(1,1)

Estimation strategy DCC-MGARCH

- Conditional volatilities in the DCC-MGARCH given by the conditional variance-covariance matrix H_t with

  $$H_t = D_t R_t D_t$$

- D_t matrix of standardized conditional variances $\mathrm{diag}(\sqrt{h_{iit}})$
- R_t correlation matrix with conditional volatility correlations

$$\rho_{ijt} = \frac{h_{ijt}}{\sqrt{h_{iit}}\sqrt{h_{jjt}}}$$

(cond. covariance)
(cond. stand. dev.)

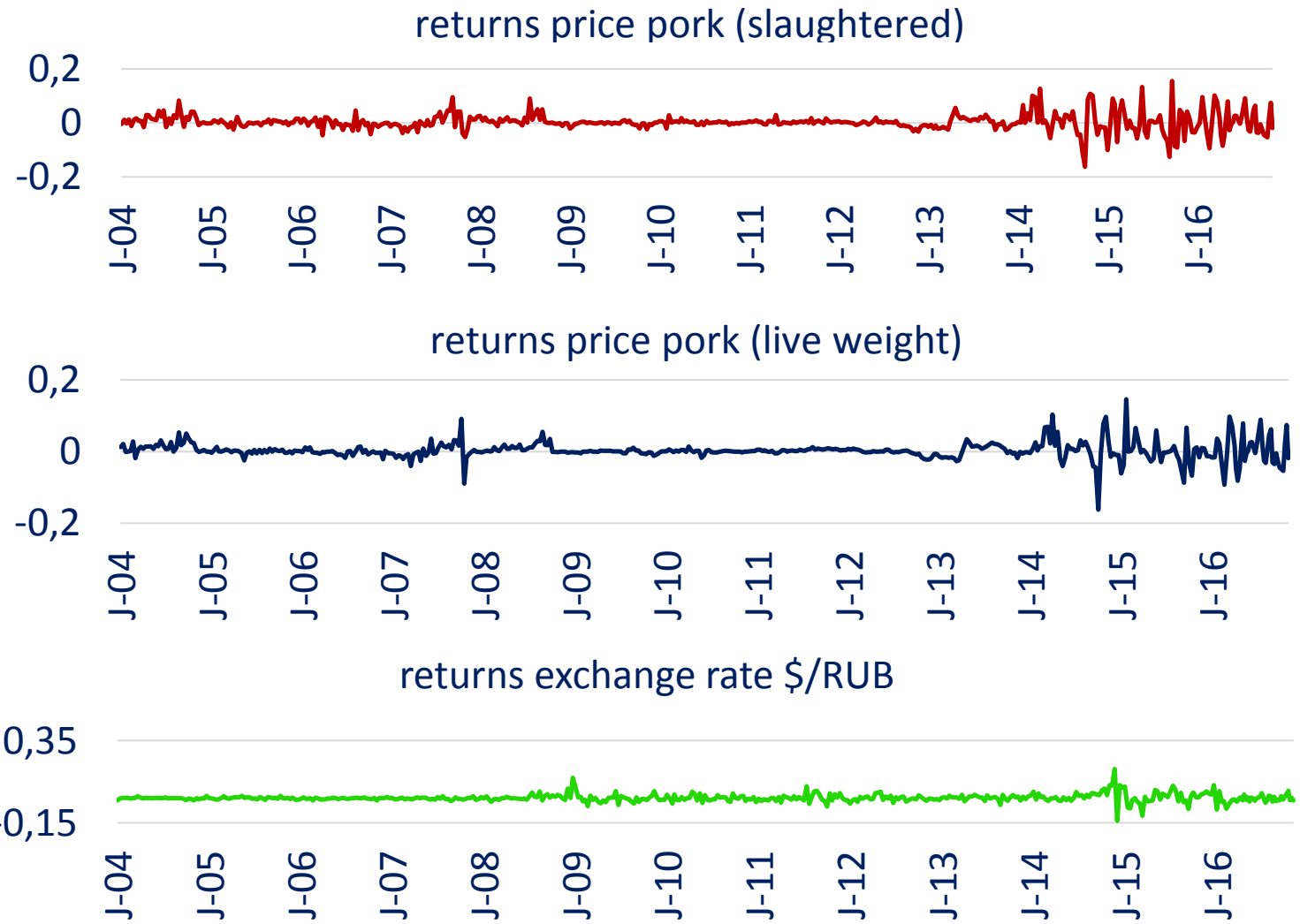
DCC-MGARCH

- D_t and H_t used to estimate parameters of R_t by maximum likelihood method

Estimation results

- ARMA(1,1) assuming t-distribution best fits the returns series
- Lagrange Multiplier (LM) test suggests ARCH effects
- Ljung-Box autocorrelation test does not allow rejecting the null hypothesis (randomness of ε_{it}, not Portmantau test for overall conditional heteroskedsticity)
- Univariate GARCH(1,1) models specified according to information criteria and maximum log-likelihood value
- Engle and Sheppard (2001) test reject the null hypothesis of correlation constancy →DCC-MGARCH

Returns series



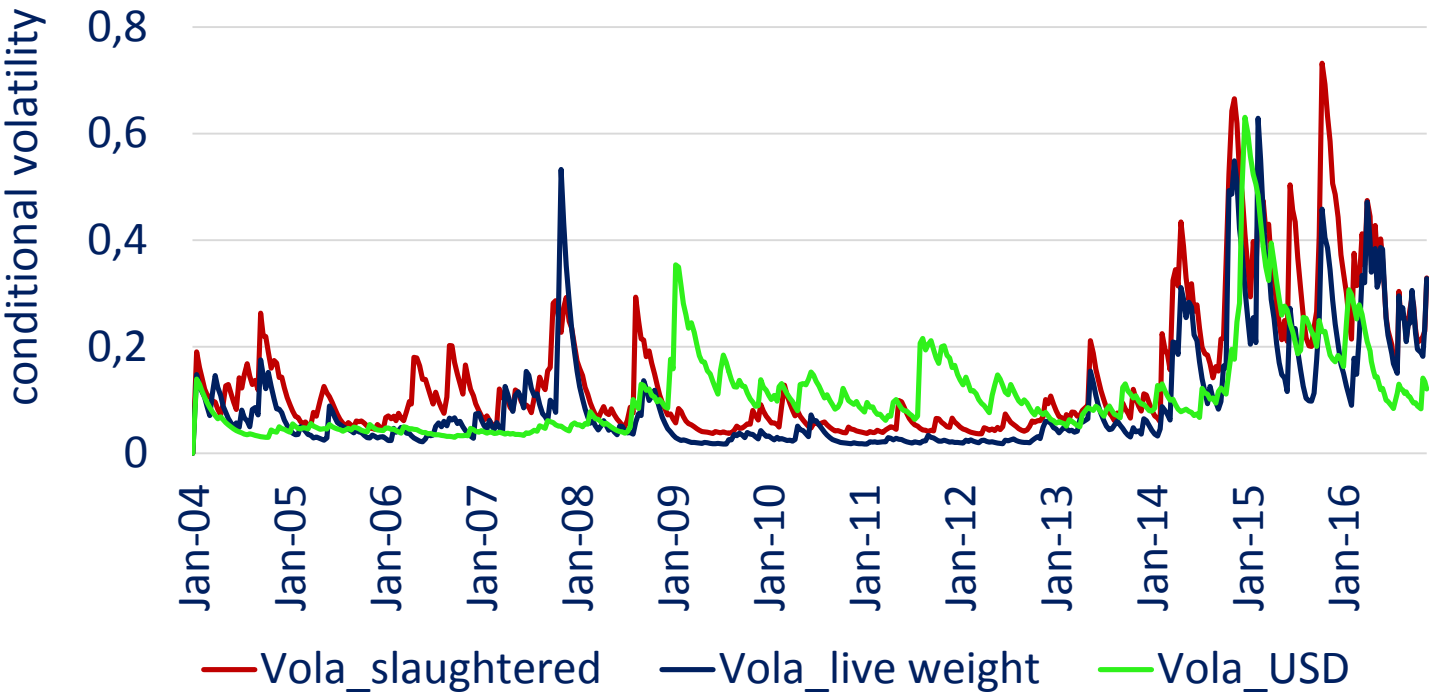
Source: Own illustration

Estimation results DCC-MGARCH(1,1)

	Price live weight pork	Price slaughtered pork	RUB/$
γ_{0i} (drift)	0.001 (0.001)	0.001* (0.001)	-0.001* (0.001)
γ_{1i} (autoregr. p.)	0.80*** (0.07)	0.80*** (0.07)	0.70*** (0.091)
γ_{2i} (mov. avg. p.)	-0.57*** (0.10)	-0.33** (0.11)	-0.59*** (0.10)
α_i (ARCH eff.)	**0.30 ***** (0.07)	**0.34***** (0.08)	0.20*** (0.04)
β_i (GARCH eff.)	**0.70***** (0.13)	**0.66***** (0.12)	0.80*** (0.05)
DCC_α	**0.04*** (0.01)		
DCC_β	**0.96*** (0.01)		

Source: Own illustration

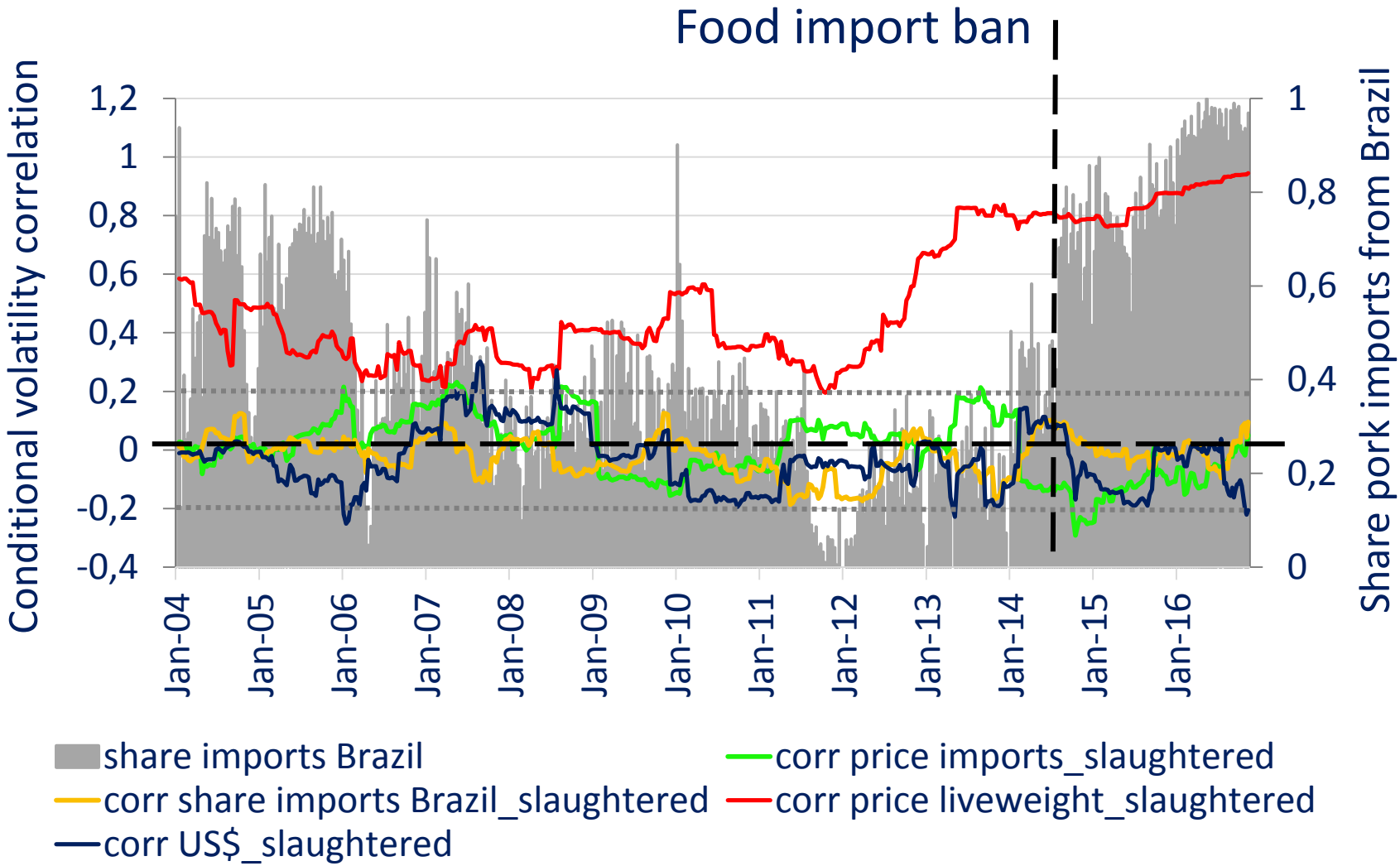
Conditional standard deviation (annualized)



in %	mean	stand. dev.	min.	max.
price pork slaughtered	14.4	12.8	3.7	73.2
price pork live weight	9.9	10.9	1.8	62.9
RUB/$	11.1	8.8	3.0	63.1

Source: Own illustration

Conditional volatility correlation



Conclusions

- Price volatility & risk strongly increased in the pork supply chain
- Rise in interdependence between slaughtered pork price and the live weight pork price
- World market factors seem not to have influenced pork price volatility in Russia
- Results suggest that domestic factors drive pork price volatility

Discussion & future research

- Increased price volatility hampers optimal pork production and processing decision
- Counteracts the aims of the import substitution policy to increase investments
- Possibly has accelerated structural change in the pork supply chain
- Further research:
  - Investigate development of the domestic pork supply elasticity
  - Using BEKK-MGARCH to test the direction of volatility spillover, its magnitute and robustness of the results

Thanks for your attention!