A model of interregional migration under the presence of natural resources: theory and evidence from Russia

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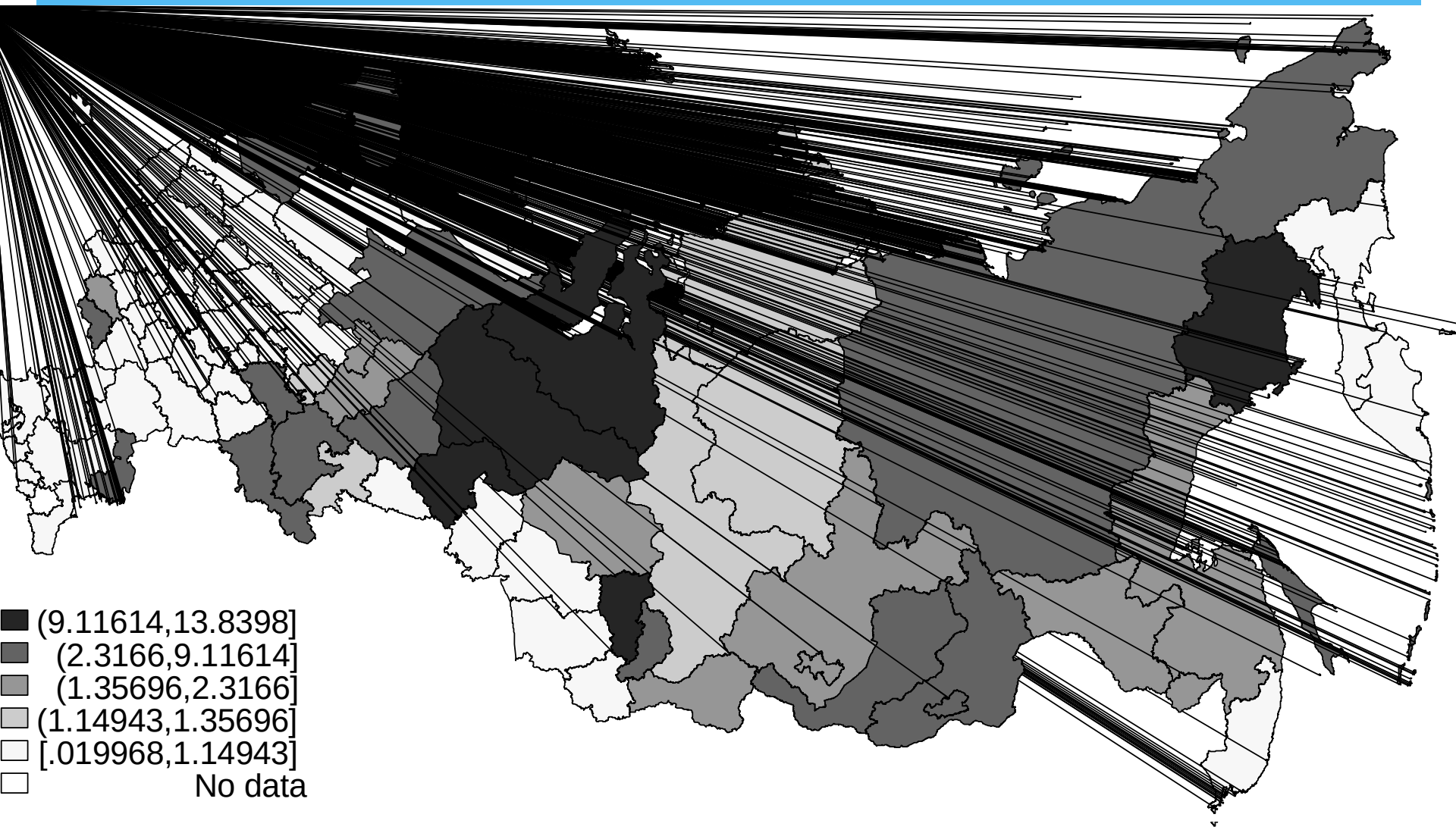

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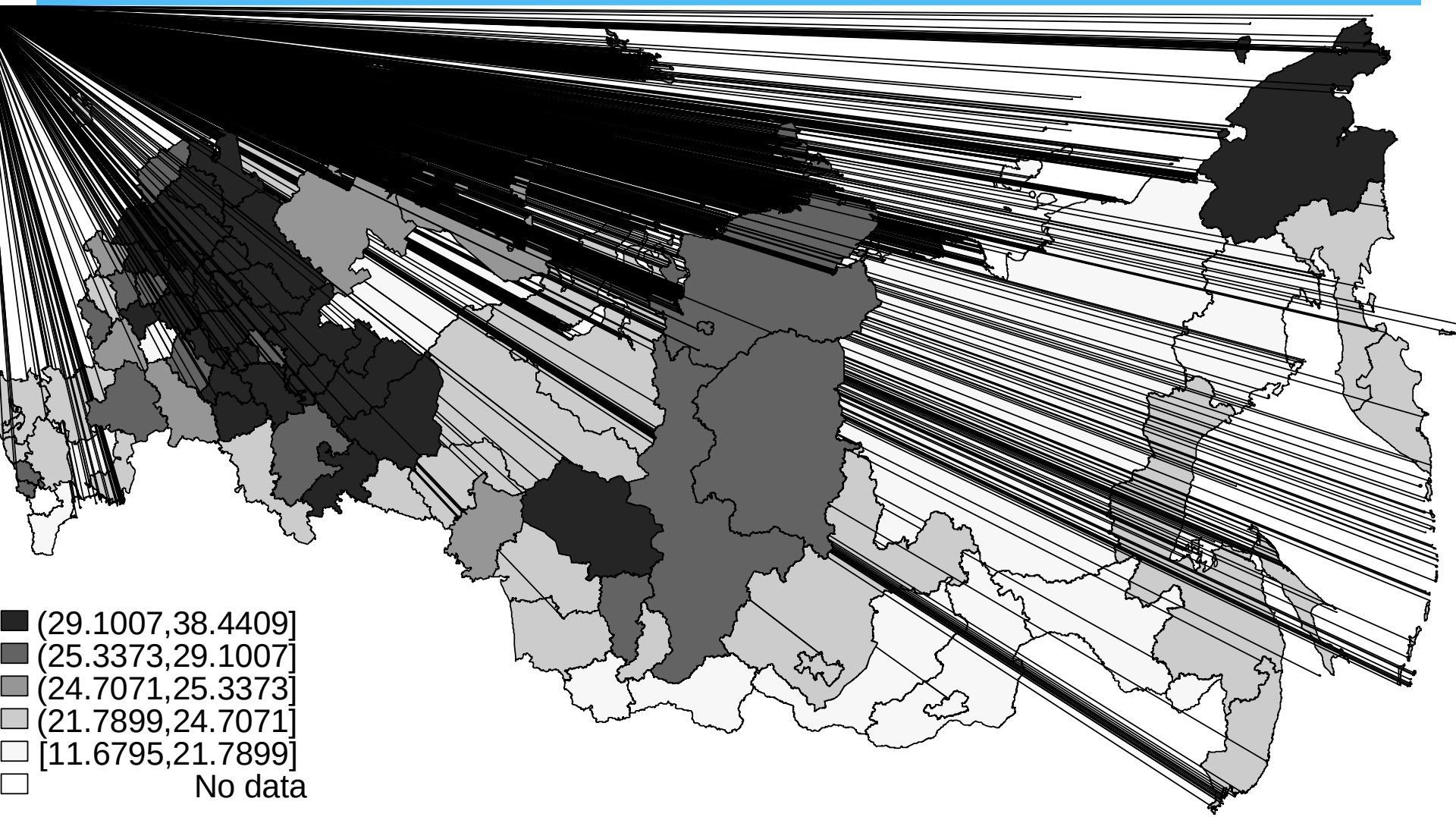

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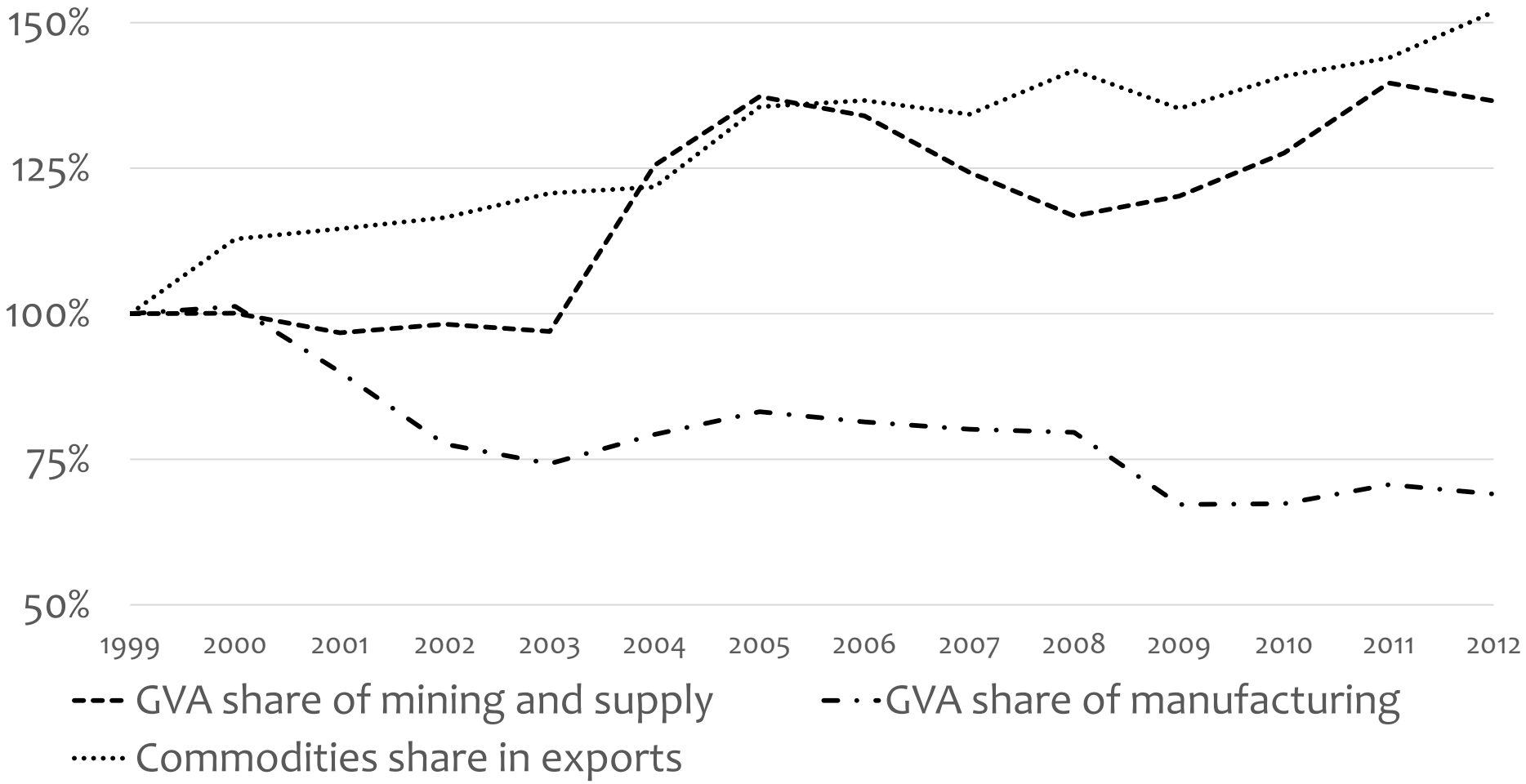

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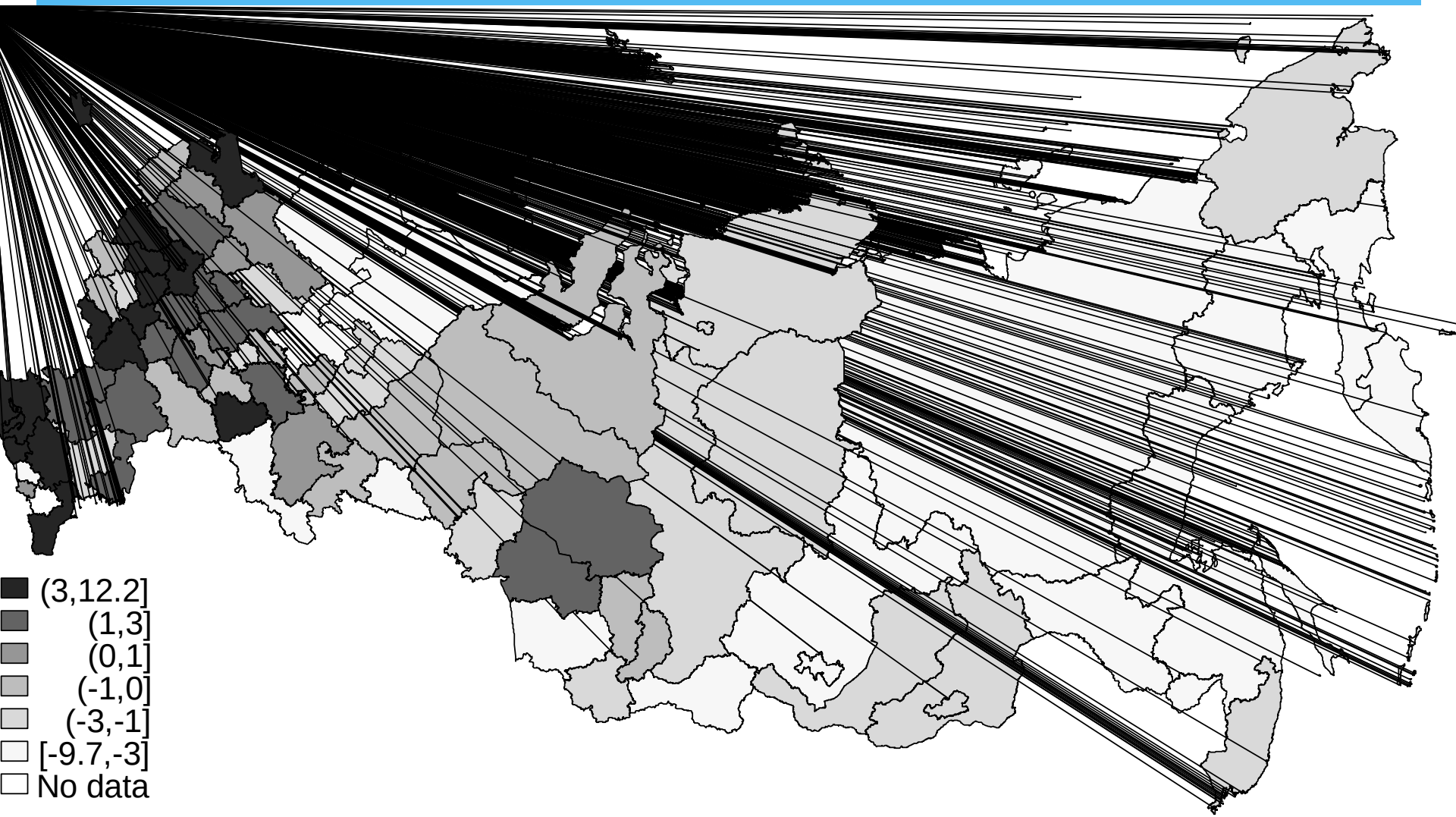

Objectives of the paper

- Crozet (2004) augments Krugman's (1991) model by a service goods sector.
- We augment Crozet's model by a commodities goods sector.
- The theoretical model is transformed into an econometric specification.
- We use sector specific data for 78 Russian regions for the observation period 2004-2010.

Assumptions of the theoretical model

- Four sectors: agriculture, commodities, manufactured goods, service goods.
- Workers in agricultural sector cannot move, while the good can be traded at zero cost.
- All other workers are mobile and may migrate.
- The commodities sector displays decreasing returns.
- Manufactured and service goods sectors are monopolistically competitive and produce horizontally differentiated goods (increasing returns).

Assumptions of the theoretical model

- Manufactured goods are traded throughout the economy, where trade induces transport cost.
- Service goods can be consumed only in those regions where they are produced.
- Consumers prefer goods varieties.
- Commodities are not consumed but exported to other countries at world market prices.

Results of the theoretical model

- Workers (= consumers) prefer large regions which are centrally located.
- Labour demand in commodities sector depends on world-market price-changes.
- Migration from region *i* to region *j* depends also on wages, labour market conditions and relations between regions.

Migration utility function

$$V_{ij,t} = \ln\left(\omega_{j,t-1}\rho_{j,t-1}r_{ij}\right)$$

$$\omega_{j,t} = \frac{w_{j,t}}{P_{j,t}}$$

$$\rho_{j,t} = \left(\frac{d\ln L_{B,j,t}}{dt}\right)^{\psi_1} L_{B,j,t-1}^{\psi_2} u_{j,t-1}^{-\psi_3} S_{j,t-1}^{\psi_4}$$

$\omega\ldots$ real wage
$\rho\ldots$ job-finding probability
$r\ldots$ relationship between i and j
$w\ldots$ nominal wage
$P\ldots$ price level
$L_B\ldots$ labour demand in commodities sector
$u\ldots$ unemployment rate
$e\ldots$ employment rate
$\vartheta\ldots$ parameter
$\Delta\ldots$ common border dummy
$S\ldots$ population size
$\lambda\ldots$ parameter

$$r_{ij} = \delta_{ij}^{-\lambda_1}\left(1+\vartheta\Delta_{ij}\right)^{-\lambda_2}$$

$$\vartheta > 0, \qquad \lambda > 0$$

Migration flows

$$\frac{M_{ij,t}}{\sum_{j=1}^{N} M_{ij,t}} = \frac{\exp V_{ij,t}(g)}{\sum_{j=1}^{N} \exp V_{ij,t}(g) - \exp V_{ii,t}(g)}$$

$$\ln M_{ij,t} - \ln \sum_{j=1}^{N} M_{ij,t} = \ln \omega_{j,t-1} + \ln \rho_{j,t-1} + \ln r_{ij} - \ln \tilde{\alpha}_{i,t-1}$$

$M\ldots$ number of migrants
$V\ldots$ utility
$g\ldots$ potential migrant

$$\tilde{\alpha}_{i,t} = -\sum_{j=1}^{N} V_{ij,t}(g) + V_{ii,t}(g)$$

Migration flows

$$\ln M_{ij,t} - \ln \sum_{j \neq i}^{N} M_{ij,t} = (1-\mu)\ln w_{j,t-1} - \phi \ln P_{C,j,t-1} + \frac{\mu}{\sigma_D - 1}\ln L_{D,j,t-1} +$$

$$\psi_1 \ln\left(\frac{\dot{p}_{B,t}}{p_{B,t}} - \frac{\dot{w}'_t}{w'_t}\right) + \psi_2 \ln L_{B,j,t-1} - \psi_3 \ln u_{j,t-1} + \psi_4 \ln S_{j,t-1} -$$

$$\lambda_1 \ln \delta_{ij} - \lambda_2 \ln\left(1 + \vartheta \Delta_{ij}\right) + \psi_1 \ln \frac{x_i}{x_i - 1} - \tilde{\alpha}_{i,t} + \tilde{\beta}_D$$

$$\tilde{\beta}_D = \mu(\sigma_D - 1) - \left(\mu/(\sigma_D - 1)\right)\ln \alpha_D - \left(\mu\sigma_D/(\sigma_D - 1)\right)\ln \sigma_D - \mu \ln \beta_D$$

Econometric specification I: Gravity interpretation

$$\ln M_{ij,t} - \ln \sum_{j=1}^{N} M_{ij,t} = \alpha_i + \beta_0 + \beta_1 \ln w_{j,t-1} + \beta_2 \ln L_{j,t-1} +$$

$$\beta_3 \ln u_{j,t-1} + \beta_4 \ln e_{j,t-1} + \beta_5 \ln \delta_{ij} + \beta_6 \Delta_{ij} + \varepsilon_{i,t}$$

	(1)	(2)	(3)
Regional nominal wage	0.634*** (0.081)	0.192*** (0.044)	0.159*** (0.041)
Total employment	0.776*** (0.017)		
Employment sector A		-0.045** (0.020)	-0.018 (0.016)
Employment sector B		0.062*** (0.009)	0.061*** (0.009)
Employment sector C		-0.332*** (0.054)	-0.299*** (0.051)
Employment sector D		1.112*** (0.052)	1.325*** (0.131)
Unemployment rate	-0.278*** (0.030)	-0.386*** (0.022)	-0.361*** (0.028)
Population size			-0.266* (0.134)
Distance	-0.472*** (0.032)	-0.570*** (0.031)	-0.579*** (0.032)
No border	-1.430*** (0.079)	-1.281*** (0.070)	-1.266*** (0.068)
Constant	-6.356*** (0.268)	-10.405*** (0.330)	-10.033*** (0.438)
Observations	35,294	34,440	34,440
R^2	0.678	0.691	0.691
LIK	-41,823	-39,956	-39,941

Notes: The estimations have been carried out with Stata, White robust standard errors in parentheses. Stars indicate the corresponding significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, where p symbolises probability values. “LIK” refers to the values of the maximised log-likelihood. 77 fixed effects for source region are included in the model.

Econometric specification II: Direct model specification

$$\ln M_{ij,t} - \ln \sum_{j \neq i}^{N} M_{ij,t} = \alpha_i + \beta_1 \ln w_{j,t-1} + \beta_2 \ln L_{B,j,t-1} + \beta_3 \ln L_{D,j,t-1} +$$

$$\beta_4 \ln P_{C,j,t-1} + \beta_5 \ln u_{j,t-1} + \beta_6 \ln S_{j,t-1} + \beta_7 \ln \delta_{ij} + \beta_8 \ln \xi_{ij} + \beta_9 \ln \pi_t + \varepsilon_i$$

$$\alpha_i = -\sum_{t=2}^{T} \tilde{\alpha}_{i,t} + \psi_1 \ln\left(x_i / \left(x_i - 1\right)\right) + \tilde{\beta}_D$$

$$\xi_{ij} = 1 + \vartheta \Delta_{ij}$$

$$\ln \pi_t = \ln\left(0.4 + \left(p_{B,t} - p_{B,t-1}\right) / p_{B,t-1} - \left(w'_t - w'_{t-1}\right) / w'_{t-1}\right)$$

$$\vartheta = \exp(1) - 1$$

$L_B \ldots$ labour demand in commodties goods sector
$L_D \ldots$ labour demand in service goods sector
$p_B \ldots$ world-market price for commodities

	(1)	(2)	(3)
Regional nominal wage	-0.003 (-0.033)	-0.158*** (-0.034)	0.198*** (-0.030)
Employment sector B	0.072*** (-0.003)	0.077*** (-0.003)	0.060*** (-0.004)
Employment sector D	1.116*** (-0.044)	1.023*** (-0.043)	1.263*** (-0.042)
Subsistence level	0.217*** (-0.019)		
Basket of goods		0.429*** (-0.022)	
Market potential			-0.031*** (-0.006)
Unemployment rate	-0.293*** (-0.013)	-0.310*** (-0.013)	-0.304*** (-0.015)
Population size	-0.360*** (-0.045)	-0.262*** (-0.044)	-0.475*** (-0.046)
Distance	-0.577*** (-0.007)	-0.583*** (-0.007)	-0.580*** (-0.008)
ξ	-1.267*** (-0.023)	-1.260*** (-0.023)	-1.262*** (-0.023)
π	0.044*** (-0.008)	0.040*** (-0.008)	0.045*** (-0.008)
Constant	-11.61*** (-0.216)	-13.56*** (-0.240)	-10.62*** (-0.244)
Observations	35,294	35,294	35,294
R^2	0.693	0.695	0.692
LIK	-40,942	-40,816	-41,005

Notes: The estimations have been carried out with Stata, White robust standard errors in parentheses. Stars indicate the corresponding significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, where p symbolises probability values. "LIK" refers to the values of the maximised log-likelihood. 77 fixed effects for source region are included in the model.

Summary of empirical results

- Robust positive sign of commodities sector.
- Service goods sector has positive influence, too.
- In contrast, regional price-level is unexpectedly positive.

Conclusions

- The theoretical and empirical results show that the commodities sector attracts migrants.
- Empirical results show that real wages are relatively unimportant.
- Commodities sector may slow down population decrease in eastern regions.