Regional non-survey input-output multipliers: do regional data adjustments improve the household-endogenized model?

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We construct total regional multipliers for Russian regions with consideration of information on the regional structure of consumption, employment composition, and savings rate.

We test whether the forementioned factors, being introduced into the calculation, noticeably impact regional multipliers values.

Methodology

Data

Calculations are based on the national IO tables (2016) and regional employment, household income and expenditures, demographic, tourism data (2016, 2013-2019) provided by Rosstat

Methodology

Total multipliers

$$B = \begin{bmatrix} A & h \\ w & 0 \end{bmatrix}$$

$$\tilde{L} = \left(I - B \right)^{-1}$$

$$\tilde{M}_j = \sum_{i=1}^{n} \tilde{l}_{ij}$$

The household sector in the matrix is represented by:

labor input coefficients w, which are calculated as shares of wages in output

$$w_j = \frac{W_j}{X_j}$$

coefficients of household expenditure on final consumption h, which are calculated as shares of consumption vector *hc* in the total household income

$$h_i = \frac{hc_i}{Y}$$

Methodology

LQ

We use simple location quotients based on employment data:

$$LQ_i = \frac{x_i^r / x^r}{x_i^n / x^n} = \frac{x_i^r / x_i^n}{x^r / x^n}$$

where x_i^r and x_i^n –employment in i-th industry in the regional economy and national economy, respectively, x^r and x^n – employment in the regional economy and national economy, respectively

Methodology

Adjustments: regional differences in the propensity to consume

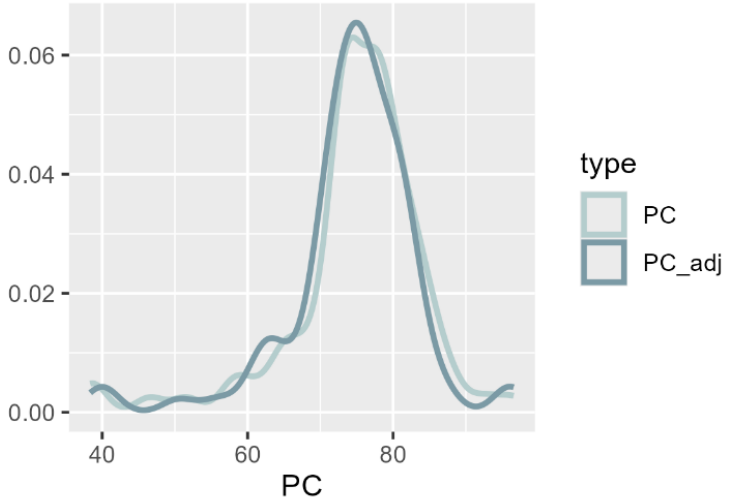
We regard regional average propensity to consume (PC) indicators to look at the potential significance of regional differences in the context of how it may affect the induced effects size

PC official methodology in Russia: income indicators depend on the territorial affiliation of the employer organization, and consumption expenditure indicators depend on the territorial affiliation of the trade organization.

Therefore, regions with a high share of labor migrants show lower PC (income is formed but not spent in the same region); regions with a high number of tourists show higher PC (income generated in other regions is spent in the region under consideration).

The estimation of induced effects at the regional level requires the increase in labor income and its transformation into consumption in the same region. Thus, to avoid the distortions of regional induced effects estimates, we eliminate labor migrant and tourism factors from the PC values to obtain the modified PC by regression analysis. We control economic and demographic factors by additional variables.

$$log\ P\ C_{rt} = \alpha + \beta_1 log\ Tour_{rt} + \beta_2 log\ Migr_{rt} + \beta_3\ log\ Income_{rt} + \beta_4\ log\ A\ ge_{rt} + \beta_5 Crisis$$



Intercept	3,675	(0,000)
Tour	0,063	(0,000)
Migr	-0,013	(0,043)
Income	-0,154	(0,000)
Age	0,609	(0,000)
Crisis	-0,038	(0,000)

R2 adj	0,398
F-stat	77,15
p-Value	0,000

$$PC_r^{adj} = \frac{PC_r}{Tour_r{}^{\beta_1} \times Migr_r{}^{\beta_2}}$$

Methodology

Adjustments: regional differences in the propensity to consume

Given that $Y = C/pc$, the formula for the regional vector of household consumption coefficients h^r of region r will look as presented in the formula below:

$$h_i^r = \frac{hc_i^N}{C^N / PC_r^{adj}}$$

where hc_i^N – volume of consumption of products of industry i in the national flow matrix, C^N – total household consumption in the national flow matrix

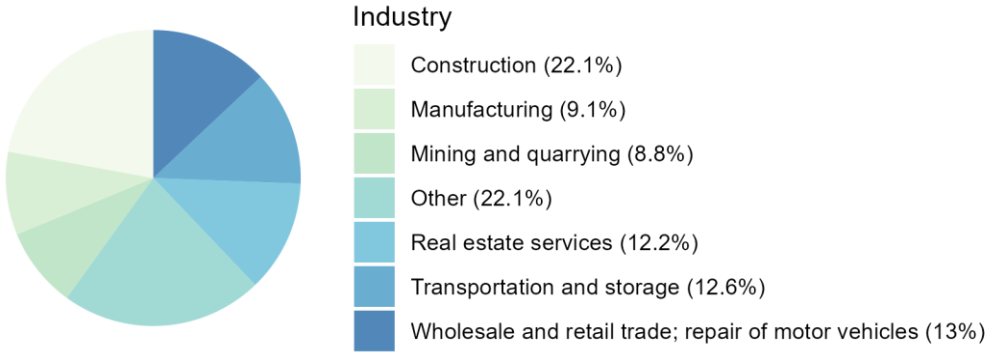
Methodology

Adjustments: labor migration

Russian regions differ significantly in the contribution of labor migration to employment

Region	Number of migrants to the total number of employed ratio, %
Yamalo-Nenets	21.0
Moscow city	16.0
Khanty-Mansi	14.0
Chukotka	9.2
Moscow oblast	6.3
St. Petersburg	6.0
Sakha	5.2

Labor migration is unevenly distributed across industries: in 2016, construction accounted for about 22% of labor migrants in Russia (which can be compared to the construction sector's share of the total employment structure, which is about 9%), trade, transport and various services each make up 12-13%, and mining and manufacturing each – 8-9%.



Methodology

Adjustments: labor migration

The adjustment for labor migration is made as follows:

$$w^M = \hat{M}w$$

where w^M is a vector of wage coefficients adjusted for the migration factor, $\hat{M} = diag(1 - m_i/e_i)$ where m_i is the number of migrants in industry i, e is the total number of employed in the industry, w – initial vector of wage coefficients.

It is assumed that the volume of the wage fund, which will form the regional consumption and savings, can be proportionally divided between local and migrant workers.

This will reduce the value of calculated total multipliers by reducing the volume of household incomes transformed into consumption.

Methodology

Adjustments: regional consumption patterns

Regions are characterized by different structures of consumption expenditures. This can be taken into account by changing the structure of the household final consumption vector:

$$h_i^r = \frac{hc_i^r}{Y}$$

$$hc_i^r = s_i^r \frac{hc_i^N}{s_i^N}$$

where s_i^r and s_i^N are regional and national shares of households' consumption of the group of goods and services *i* in the consumption structure, respectively.

The regional consumption structure is incorporated into IO analysis after being transformed to IO classification using the concordance table.

Regional consumption structure

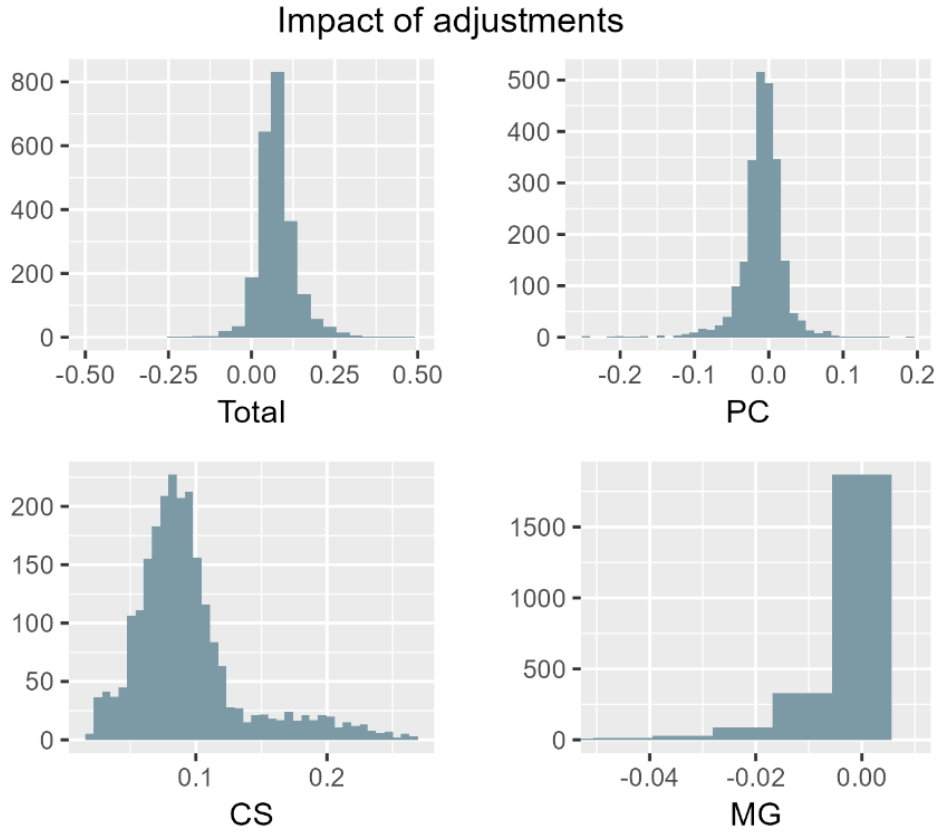
	Moscow city	Nizhny Novgorod	Krasnodar	Sverdlovsk	Khanty Mansi
Food and non-alcoholic beverages	28.6	29.5	32.5	30.5	27.7
Alcoholic beverages, tobacco	3.6	2.2	2.5	3.9	3
Clothing and footwear	11.2	9.6	9.6	7	10.2
Housing, water, electricity, gas and other fuels	9.1	10.3	11.4	12.3	11.5
Furnishings, household equipment and routine household maintenance	7.6	5.6	5.2	4.8	7.1
Health	2.8	4.4	3.5	5.3	2.7
Transport	11.5	17.3	11	13.2	17.2
Information and communication	3.3	3.1	3.9	2.8	3.7
Recreation, sport and culture	6.5	8.1	7	9.3	7.3
Education services	0.4	0.5	1.9	0.8	0.8
Restaurants and accommodation services	6	2.8	3.1	4	2.4
Miscellaneous goods and services	9.4	6.6	8.4	6.1	6.4

Results

Estimates for 83 regions and 30 industries

Impact of regional total multipliers adjustments: the distribution of the difference between the values of unadjusted multipliers and adjusted ones, including total adjustment (Total) and partial adjustments (PC, CS, MG)

Migration factor seems not to affect significantly even regions with large share of migrant workers in the economy; maximum difference here is about -0.04. Propensity to consume factor mostly decreases total multipliers value according to our calculations, and the difference can reach about 0.1. Consumption patterns are the source of potentially the largest differences in adjusted and unadjusted induced effects, increasing total multipliers by ~0.1 (in most cases) or more



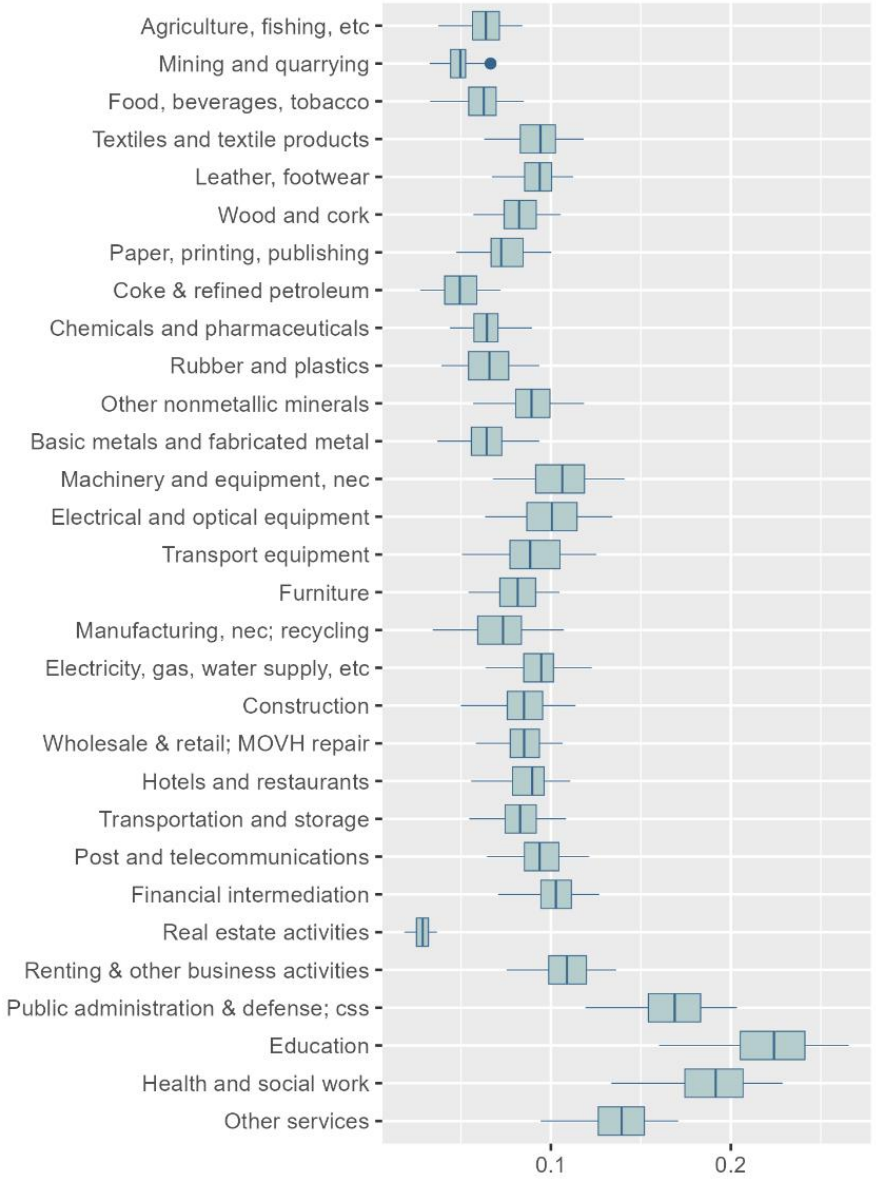
Total – full adjustment
CS –adjustment for regional consumption structure
MG –adjustment for regional labor migration
PC – adjustment for regional propensity to consume

Results

Estimates for 83 regions and 30 industries

Impact of total multipliers adjustments for regional consumption structure by industry: the distribution of the difference between the values of unadjusted and adjusted multipliers

The difference between adjusted and unadjusted multipliers can reach 0.3 in Bashkortostan, Rostov, Sverdlovsk and some other regions for education, health and social work, i.e. industries representing the public sector in Russia; the public sector has relatively large share of the compensation of employees in the output structure and thereby is sensitive to changes in income



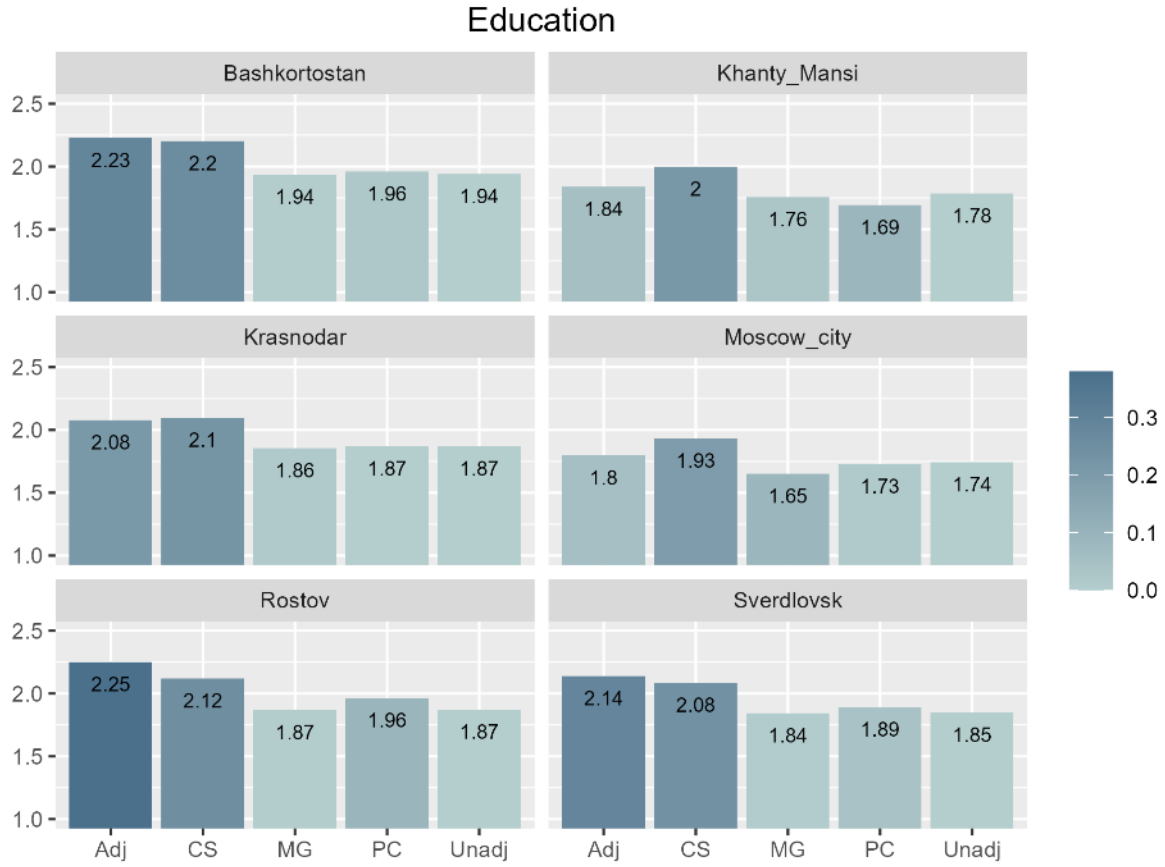
Results

Estimates for education sector in certain regions

Total multipliers for education

Adj – full adjustment
CS –adjustment for regional consumption structure
MG –adjustment for regional labor migration
PC – adjustment for regional propensity to consume
Unadj – unadjusted

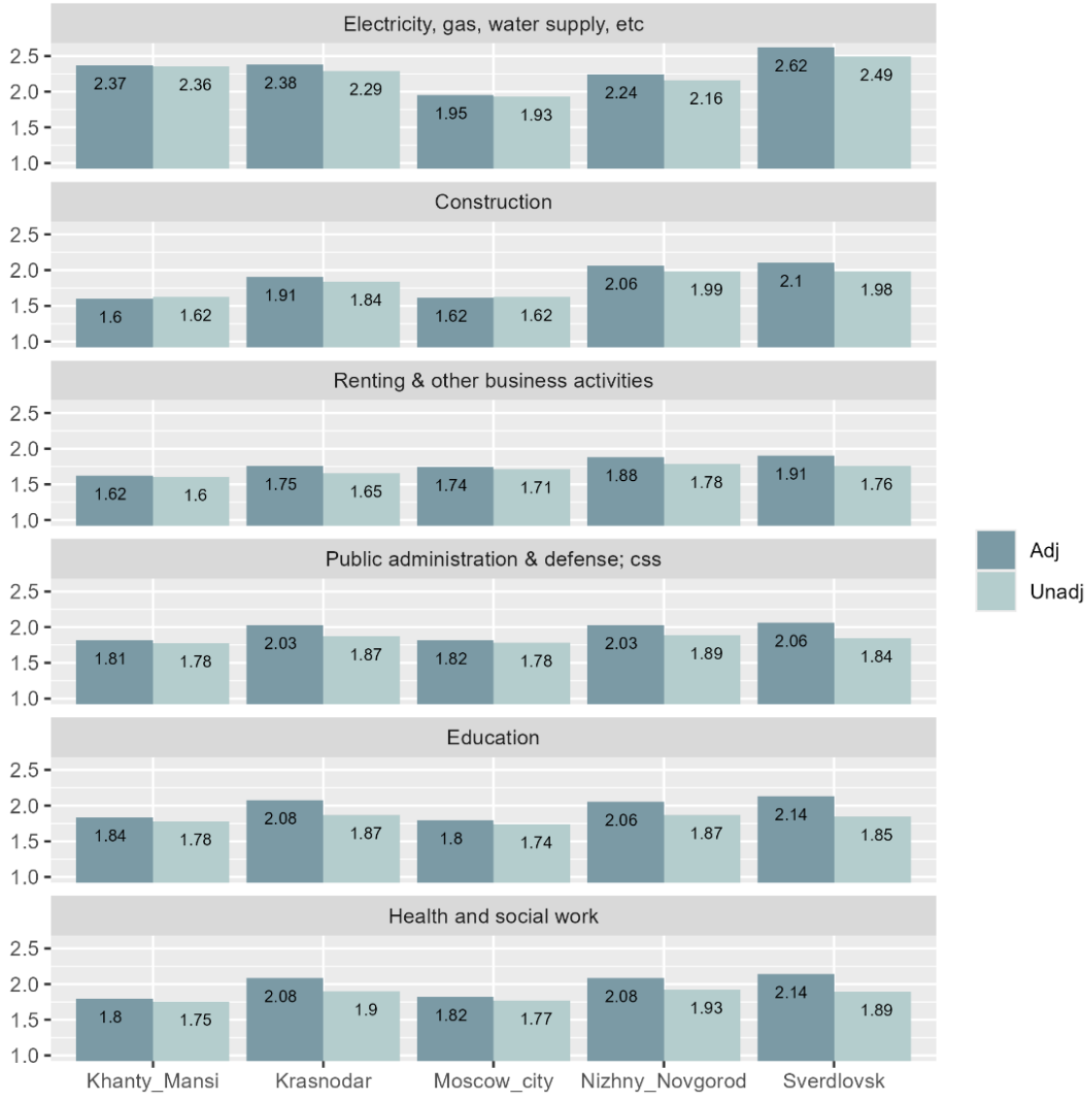
Multipliers with larger absolute changes due to adjustments are marked in darker color



Results

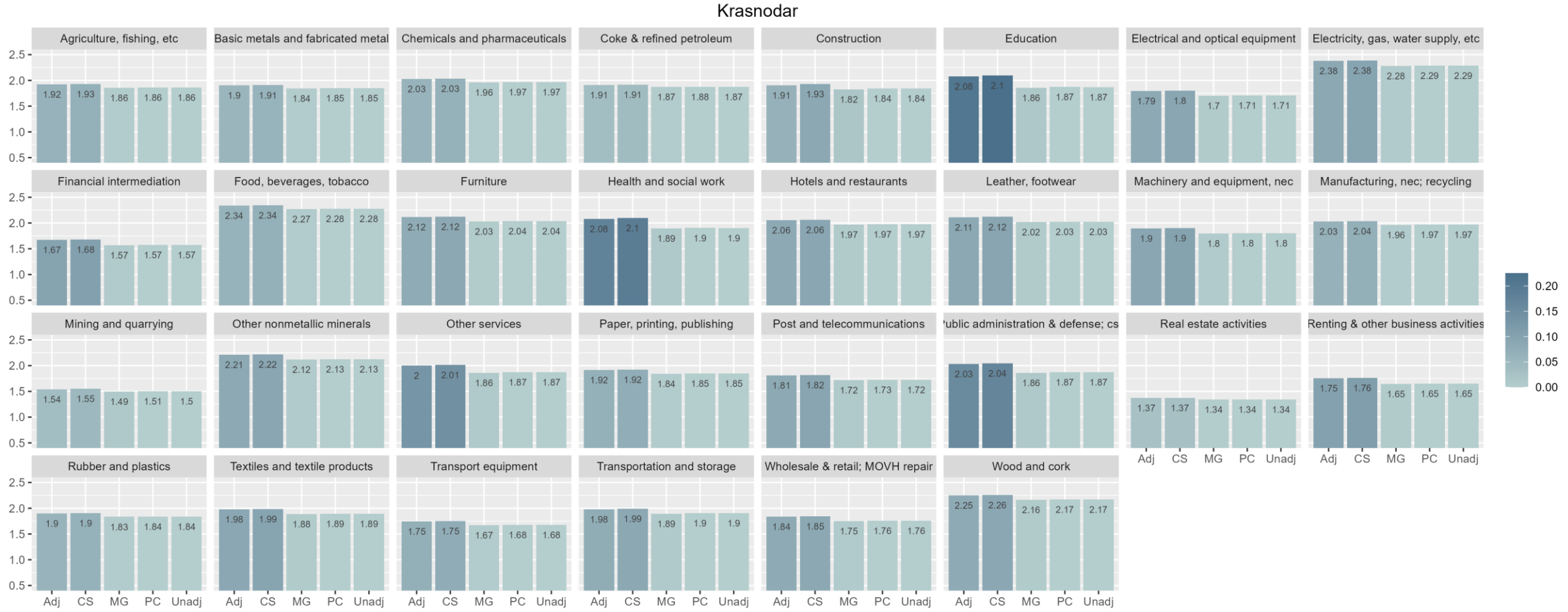
Estimates for certain sectors in five regions

Full adjusted (Adj) and unadjusted (Unadj) multipliers for certain regions and industries



Results

Estimates for 30 sectors in Krasnodar region



Multipliers for larger absolute changes due to adjustments are marked in darker color

Conclusion

The use of additional regional statistical data allows to obtain more well-founded and cogent estimates of regional total multipliers.
The adjustments are better to apply in case of regions with a significant proportion of migrant workers and regions with a well-developed tourism industry. These adjustments notably impact industries in the public sector (such as education and healthcare), where wages make a high proportion of output. However, for regions that deviate slightly from the average, as well as for most other sectors, such adjustments contribute minimally to the estimated total multiplier effect.