



RUSSIA
KLEMS



НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ

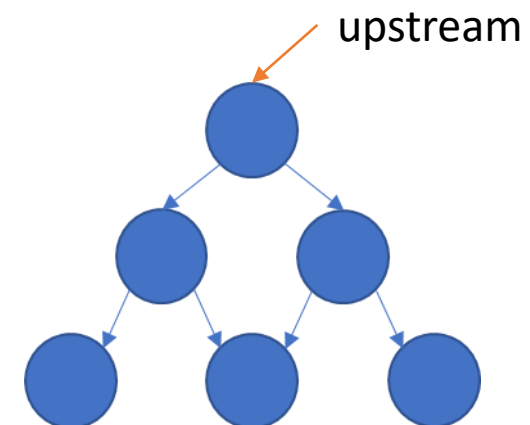
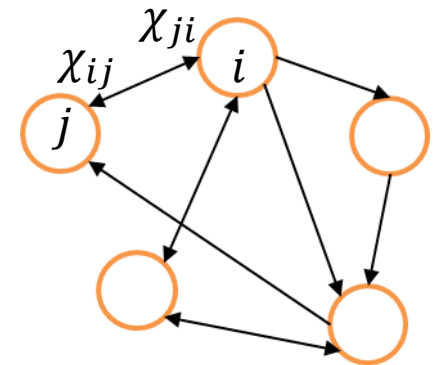
Industrial Policy and Intersectoral Relations in Russian Economy

Anton Tolokonnikov

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Market distortions and intersectoral linkages

- Market operates in the presence of market distortions between sectors (χ_{ij} , distortions) - (Jones, 2011, 2013), (Bigio & La'O, 2019)
- Market distortions are markups and transaction costs
- Market distortions lead to increase of prices of intermediate inputs (compared to undistorted economy) and decrease demand for it – size of sector shrinks
- This effect accumulates through intersectoral network. The most distorted sectors are 'upstream' sectors (suppliers of intermediate goods)



Industrial policy

- One of aspects of industrial policy – financial aid to improve position of beneficiary
- Industrial policy results in change of structure of economy, which may lead to increase of output
- Assume market distortions are exogenous, government may subsidize sectors to reallocate factors of production

Which sectors to support to decrease effect of market distortions?

Government **aiming to increase output and improve allocation of resources** (labor) should disproportionately more subsidize **sectors-suppliers** of intermediate production (upstream sectors) (Liu, 2019) :

- Reason: due to market distortions, size of these sectors is smaller than optimal
- Subsidies act like supply shocks. And supply shocks distribute mainly downstream
- Mechanism: with subsidies, these sectors will make product cheaper and increase output, which gives positive effect to other sectors. So, subsidy distributes over whole economy

Novelty and practical importance

- This is an alternative to Input-Output multipliers
- No studies of influence of subsidies on output in presence of market distortions in intersectoral Russian network
- In world: (Liu, 2019), (Bigio & La'O, 2019)

Practical importance:

- **Additional criteria for decision on government support**
- Do not consider other possible reasons for government subsidies

Methodology (Liu, 2019)

- For each sector it is possible to calculate increase in final consumption of whole economy in response to subsidizing sector by 1 ruble (**distortion centrality**)
- $\xi_j = \theta_j^F \cdot \delta + \sum_{i=1}^N \xi_i \cdot (1 + \chi_{ij}) \cdot \theta_{ij}$
- ξ_j – distortion centrality; θ_j^F – share of good j , consumed as final good; δ – normalizing coefficient; N – quantity of sectors in economy; χ_{ij} – quantity measure of inefficiency, appearing when good j is sold for production of i ; θ_{ij} – share of good j , sold for production of i
- Distortion centrality depends on well observed structure of economy (θ_{ij}) and badly observed distortions (χ_{ij}). But due to “hierarchical structure of economy”, distortion centrality depends more on structure than on distortions – values of distortion centrality are stable across specifications
- If distortion centrality is higher than 1 – subsidizing of sector increases output
- If distortion centrality is less than 1 – subsidizing of sector decreases output
- We do not assume any specific production function

Similarities in policy prescriptions for different countries

	AUS		CAN		NLD		USA		KOR		CHN	
	dist cen	rank	dist cen	rank	dist cen	rank	dist cen	rank	dist cen	rank	dist cen	rank
Crop and animal production, hunting and fishing	1,11	9	1,13	17	1,17	2	1,13	10	1,04	39	1,06	27
Forestry and logging	1,19	1	1,11	26	0,99	46	1,18	3	1,07	34	1,24	4
Fishing and aquaculture	1,01	41	1,09	32	1,15	5	1,18	4	1,03	40	0,99	38
Mining and quarrying	1,17	3	1,15	11	1,15	10	1,12	12	1,43	1	1,32	1
Man. of food products, beverages and tobacco	1,04	33	1,04	43	1,15	11	1,03	43	1,00	44	1,02	33
Man. of textiles, wearing apparel and leather	1,07	23	1,16	7	1,14	18	1,08	26	1,18	18	1,16	14
Man. of wood and of products of wood	1,12	6	1,14	14	1,12	29	1,13	11	1,17	20	1,15	16
Man. of paper and paper products	1,09	18	1,15	10	1,14	14	1,14	8	1,27	3	1,24	5
Printing and reproduction of recorded media	1,11	8	1,13	16	1,13	27	1,10	18	1,15	23	1,15	15
Man. of coke and refined petroleum	1,11	12	1,11	27	1,16	4	1,08	24	1,26	5	1,24	6
Man. of chemicals and chemical products	1,11	13	1,20	2	1,14	12	1,10	20	1,29	2	1,25	3
Man. of basic pharmaceutical products	1,02	39	1,12	24	1,14	22	1,14	9	1,01	43	0,96	41
Man. of rubber and plastic products	1,07	24	1,22	1	1,14	16	1,12	13	1,23	7	1,21	7
Man. of other non-metallic mineral products	1,11	11	1,09	30	1,13	28	1,11	15	1,14	26	1,02	34
Man. of basic metals	1,17	2	1,13	18	1,14	17	1,23	1	1,26	4	1,17	12
Man. of fabricated metal products, except machinery and equipment	1,10	17	1,13	19	1,15	8	1,14	7	1,19	15	1,12	20

Source: authors calculation on WIOT 2014 data. Assumption of open economy; distortions (χ_{ij})

assumed to be 0.1 between each pair of sectors.

In yellow color – first 5 sectors for each country

In green color – distortion centrality > 1.15

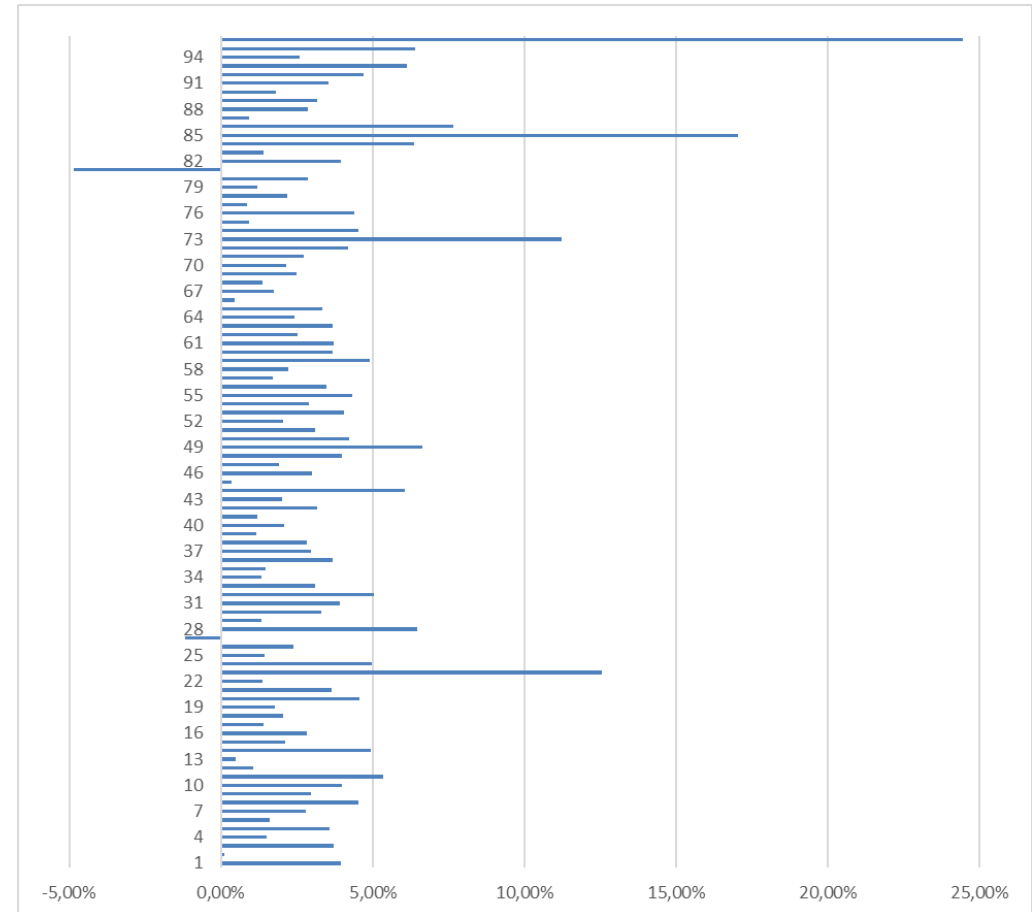
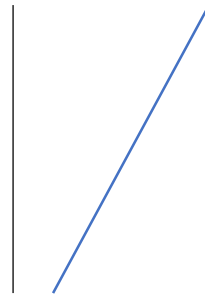
Russia

With different assumptions, same sectors are to be supported by government

Sector	With open economy adjustment				Without open economy adjustment				minimum value
	profit margin		constant 10%		profit margin		constant 10%		
	value	rank	value	rank	value	rank	value	rank	
Electricity	1,26	10	1,17	9	1,20	8	1,14	2	1,14
Rent of machinery and equipment	1,92	1	1,17	10	1,79	1	1,12	5	1,12
Support services in financial intermediation	1,28	8	1,12	22	1,27	3	1,12	7	1,12
Iron ores	1,36	4	1,24	2	1,21	7	1,12	8	1,12
Pipeline transportation services	1,36	6	1,18	7	1,22	6	1,10	11	1,10
Natural gas	1,55	2	1,19	4	1,30	2	1,10	12	1,10
Additional transport services	1,21	12	1,15	17	1,14	11	1,09	14	1,09
Cement, lime and gypsum	1,09	24	1,11	26	1,08	18	1,10	10	1,08
Train services	1,36	5	1,15	13	1,23	5	1,08	15	1,08

Russia – tax distribution

- On graph: tax of sector/VA of sector
- Sectors are arranged: with highest distortion centrality on bottom, with lowest distortion centrality on top
- Perfect distribution of taxes – higher DC – lower taxes
- In Russia DC is somewhat correlated with tax rate:
- Unweighted Correlation = -0.21
- Weighted correlation = -0.41



Natural gas sector

- Mechanism works through decrease of price of supplied good
- Government controlled price of gas in start of 2000 – made it cheaper for domestic consumers
- We could not observe this as a subsidy in data
- Control of price of gas – example of Russia using logic of the model
- Low gas prices were rejected due to other countries complaining about advantages that Russian firms received due to such subsidies when Russia joined WTO
- There were problems with implementation of the price control (OECD, Economic Surveys – Russian Federation, 2004):
 - Price of additional unit of gas (more than quota for user) was higher than average – lower incentives for production of additional units of good
 - As price in domestic market is lower, incentives for Gazprom to keep domestic pipelines in poor quality – this is comparable to negative supply shock
 - Being an owner of pipeline system, Gazprom used it to extract rent, while use of pipeline was suboptimal – also comparable to negative supply shock

Thank you for attention!

Appendix - plan

- Theoretical example
- IO multiplier
- Gov support – census data
- Upstream\downstream propagation of shocks
- Methodology
- Hierarchical structure

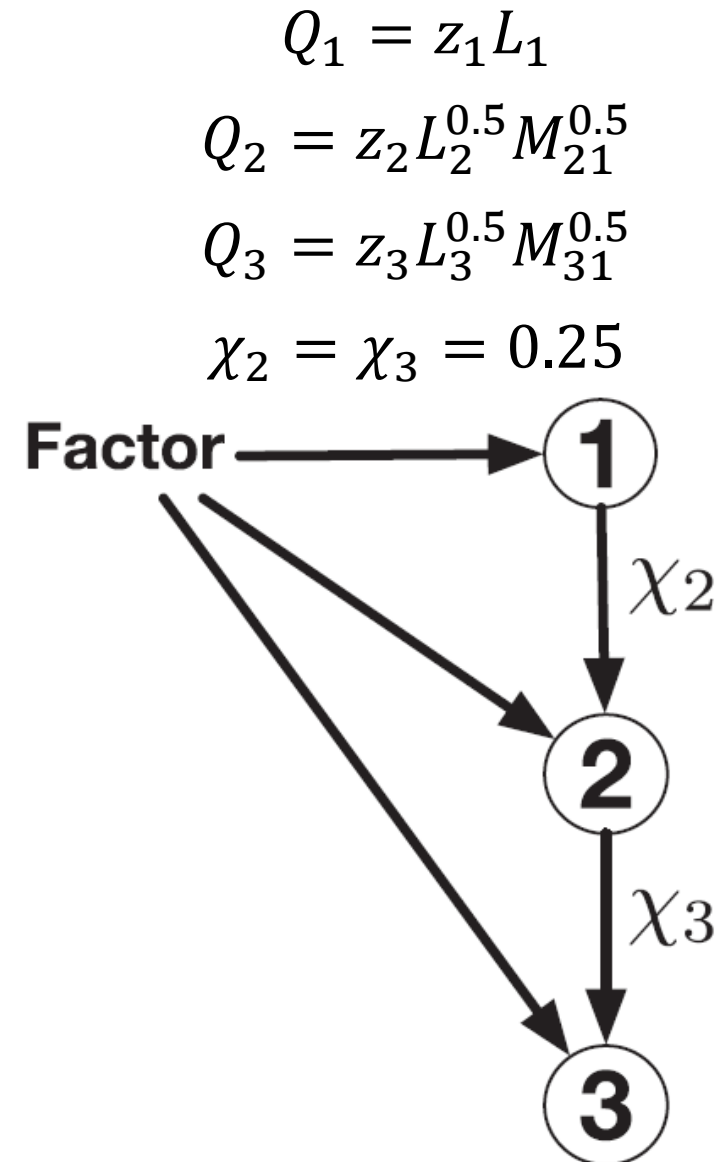
Theoretical example

- Output depends only on allocation of labor
- Market distortions cause inefficient allocation

$$\chi_2 = \chi_3 = 0.25$$

$$L_1 = 0.186; L_2 = 0.233; L_3 = 0.581; Q_3 = 5.66$$

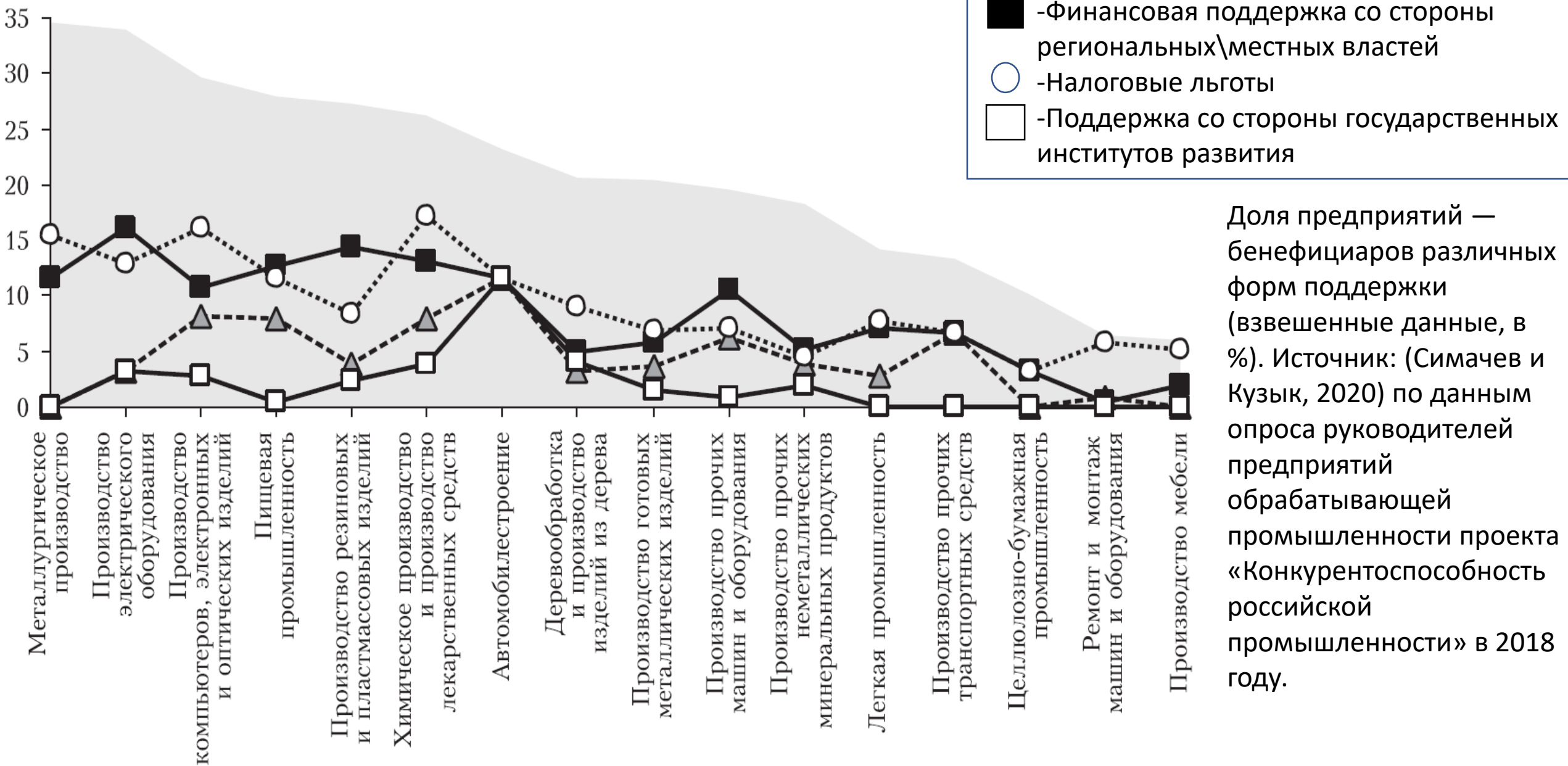
- Distortion centralities are 1.343, 1.075, 0.86 correspondingly
- Optimal allocation and output:
 $L_1 = 0.25; L_2 = 0.25; L_3 = 0.5; Q_3 = 5.75$
- Subsidies in sector 1 are the most efficient
- Subsidies in sector 3 deteriorates initial allocation



Multiplier

- Simple output multiplier (backward linkage measure) – characterizes the importance of the sectors with respect to the final demand change in the economy with Leontief production functions
- $m = \mathbf{1} * (I - W)^{-1}$
- Distortion centrality: $\xi_i \equiv \frac{\mu_i}{\gamma_i}$
- $\mu^T = \beta^T (I - A)^{-1}$ - vector of “Influence” – marginal increase in GDP in response to marginal increase of sector
- $\gamma^T = \frac{\beta^T (I - W)^{-1}}{\beta^T (I - W)^{-1} \omega_L}$ - vector of “Domar weights” $\gamma_i = \frac{p_i y_i}{GDP}$ - weight of sales of sector in output

Subsidies in Russia

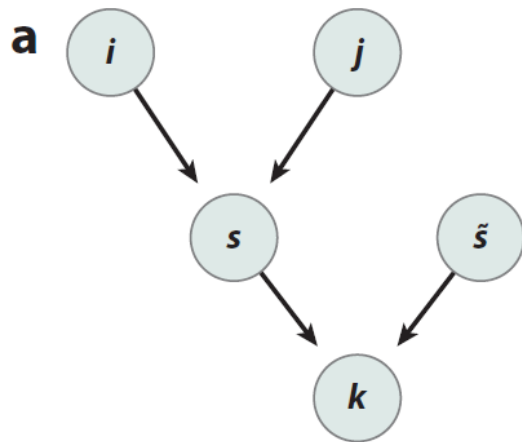


Доля предприятий — бенефициаров различных форм поддержки (взвешенные данные, в %). Источник: (Симачев и Кузык, 2020) по данным опроса руководителей предприятий обрабатывающей промышленности проекта «Конкурентоспособность российской промышленности» в 2018 году.

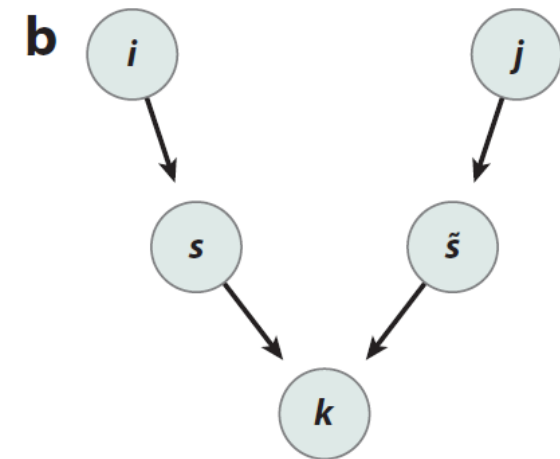
Upstream and downstream propagation of shocks

- Demand-side shocks propagate **mainly** upstream
- Supply-side shocks **mainly** propagate downstream (1st order approximation or Cobb-Douglas PF)
- CES PF captures possibility of upstream propagation
- Use of endogenous markups captures possibility of upstream propagation (Grassi, 2017), (Baqae, 2018)

a) **negative productivity shock to industry j** results in a decrease in *i*'s output. This is, of course, fairly intuitive: The fact that $\sigma_k > 1$ implies that, in response to a negative shock to *j*, industry *k* substitutes away from the production chain supplied by *j*, in the process also **reducing the demand for industry *i*'s output**.



b) a **negative shock to j** would force industry *k* to substitute away from the production chain that is supplied by *j* whenever $\sigma_k > 1$. However, unlike the previous case, such a substitution results in an **increase in *i*'s output** precisely because the production chains supplied by *i* and *j* do not overlap with one another.



Benefits for all to be enjoyed if Russia can tie the knot with WTO (Peter Chapman, 19 May 2004)

- Subsidized natural gas is often the root cause of Russian trade trouble in many of these areas - such as the chemicals used in fertilizers. Dirt-cheap energy inevitably leads to far **cheaper prices in many commodities** - where fuel costs are a big proportion of total production costs.
- The EU, for one, is keen to ensure undertakings on energy market liberalization as part of the price of WTO entry, to make sure **Russian companies can no longer benefit from this export advantage**.
- Commission trade spokeswoman Arancha Gonzalez said: "We are keen to see prices gradually move up to cover costs and a profit margin." Russia itself also seemed to be moving towards this in its domestic policy on Gazprom, she added.
- "What we need to discuss is how gradually this can be done and how it can be locked into the negotiations."
- More realistic energy markets will be good for EU firms competing with Russian rivals on a level playing field.
- For Russia, **WTO membership would boost economic growth by acting as a catalyst for competition and liberalization** in domestic industry and inward investment.
- <https://global.factiva.com/ga/default.aspx>

Methodology (Liu, 2019)

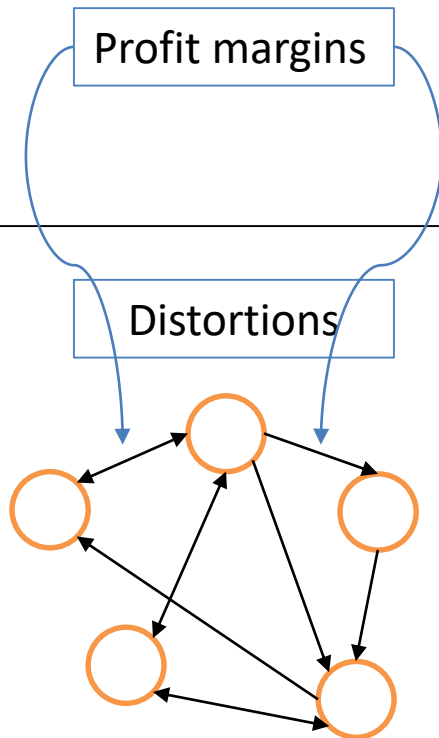
- $$\begin{cases} G + \sum_i S_i = T \\ C = WL - T \end{cases} \Rightarrow Y = WL - \sum_i S_i$$

$$Y^G - DWL \equiv Y = C + G$$
- $\Delta \ln Y \approx Cov(\xi_j, s_i)$ – weighted by share of VA covariance

Model versus Reality

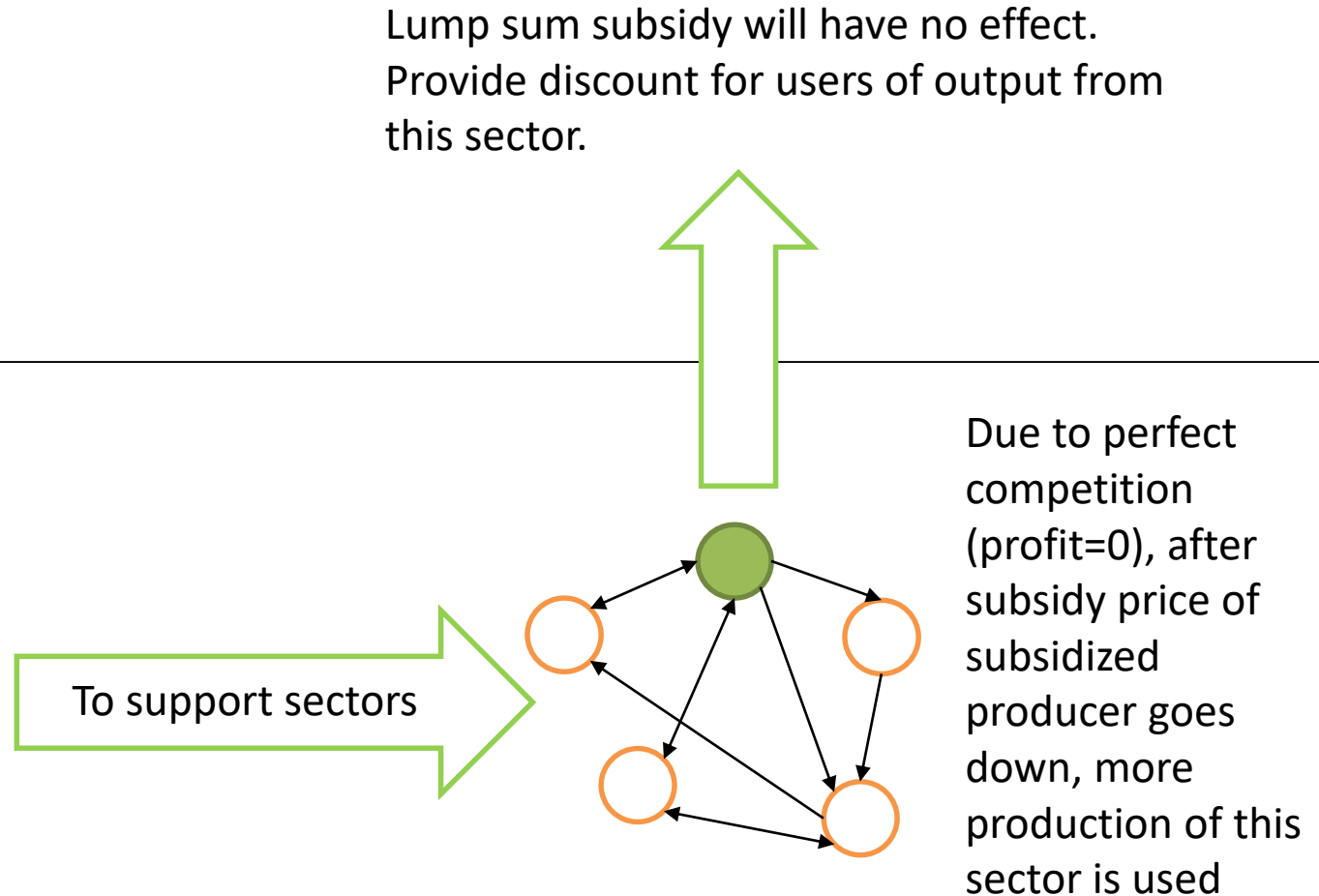
Reality

Open Economy (prices)
No perfect competition



Model

Closed Economy with
trade intermediary
sector
Perfect competition



Simulated distortions

	South Korea in 1970		China in 2007		Russia in 2016	
Distribution of x_i j 's	Pearson	Spearman	Pearson	Spearman	Pearson	Spearman
Constant distortion						
x_i $j = 0,15$	1,00	1,00	0,99	0,99	1,00	1,00
x_i $j = 0,2$	1,00	1,00	0,99	0,99	1,00	1,00
Log-Normal						
log-N (0,09;0,05)	0,98	0,97	0,99	0,99	0,95	0,96
log-N (0,15;0,05)	0,99	0,99	0,99	0,99	0,98	0,98
log-N (0,15;0,1)	0,97	0,97	0,98	0,99	0,93	0,95
Normal						
N (0,05;0,05)	0,99	0,98	0,99	1,00	0,87	0,89
N (0,1;0,05)	0,95	0,93	0,99	0,99	0,96	0,97
N (0,2;0,05)	1,00	0,99	0,98	0,98	0,99	0,99
N (0,2;0,1)	0,98	0,98	1,00	1,00	0,96	0,97
Truncated Normal (min=0)						
$m = 0,05; s^2 = 0,05$	0,97	0,95	1,00	1,00	0,98	0,99
$m = 0,05; s^2 = 0,1$	0,94	0,93	0,99	0,99	0,97	0,98
$m = 0,15; s^2 = 0,1$	0,98	0,97	0,99	0,99	0,99	0,99
$m = 0,15; s^2 = 0,2$	0,94	0,95	0,97	0,98	0,97	0,98
Uniform						
U [0;0,3]	0,98	0,98	0,99	0,99	0,95	0,96
U [0;0,4]	0,98	0,98	0,98	0,98	0,95	0,96
Exponential						
Scale = 0,05	0,95	0,94	1,00	1,00	0,87	0,92
Scale = 0,2	0,91	0,93	0,92	0,94	0,87	0,92

Предположения\Ограничения работы

- Не рассматриваются другие причины субсидий (поддержка занятости)
- Предположение совершенной конкуренции, цена равна средним издержкам
- Различные покупатели промежуточной продукции покупают одинаковый набор разнообразной продукции сектора-поставщика
- Один фактор производства (труд) или все сектора используют несколько факторов в одинаковой пропорции, иначе – эффект замещения факторов производства

Diversity of models (Carvalho & Tahbaz-Salehi, 2019)

How shocks propagate in sectoral network?

1. Models with Input-Output Linkages (Acemoglu et al., 2012)

- Downstream propagation of productivity shocks (Cobb-Douglas, single factor, CRS)
- Demand-side shocks propagate upstream (Acemoglu et al., 2016)

2. For C-D PF shares of input are invariant to productivity shocks. With use of **CES** PF, propagation patterns are richer:

- 1) Negative productivity shock in good i leads to increase in good i 's price
- 2) adversely impacts all industries that rely on good i as an input for production - downstream propagation (same to C-D PF)
- 3) reallocation of resources across different industries depending on the elasticities of substitution across various inputs: increase (decrease) in demand by i 's customers for input $j \neq i$ if goods i and j are gross substitutes (complements) in these customers' production technologies

3. Hulten's theorem $\frac{d \log(GDP)}{d \log(z_i)} = \lambda_i = \frac{p_i y_i}{GDP}$ - first order effect for any **efficient** economy

Market imperfections: exogenous wedges (or micro founded)—in the form of markups—between firms' marginal revenue and marginal costs that distort input and output choices away from efficient levels – how productivity shock propagates in economy? (depending on C-D\CES, exogenous\micro-founded)

4. Endogenous networks – networks may change (with time\in response to shocks) – statistical models\result of optimal behavior of firms. Models remain “mathematical” – we don't consider choice of suppliers with respect to technological process

5. Other modifications of model: Open economy (2n goods – foreign and domestic); with Capital and investment
I don't like open economy models – response: GE Model with several countries