

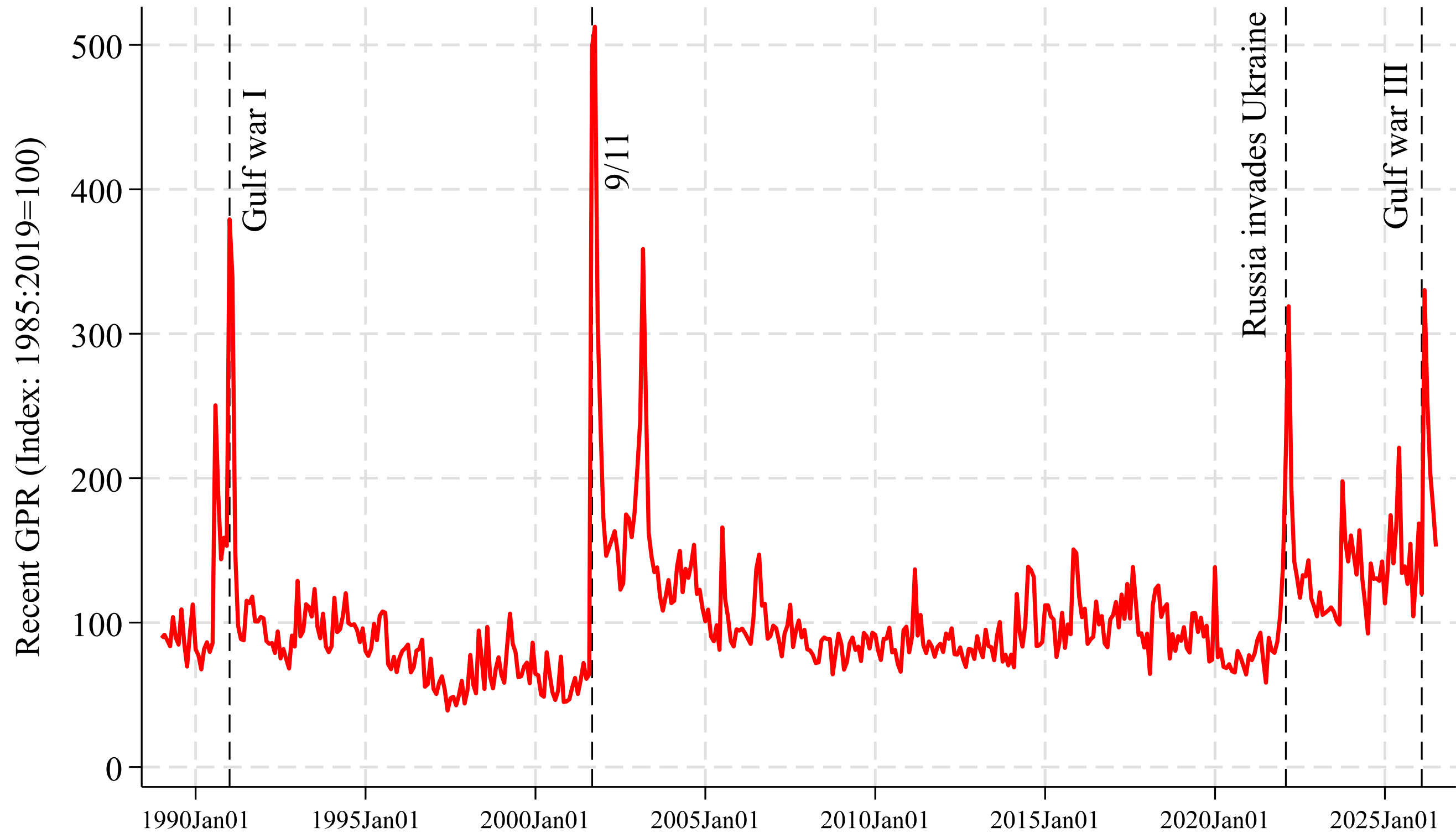
THE ALLOCATIVE COST OF WAR: A VIEW TO A KILL...ING OF PRODUCTIVITY

Marvin Amann
(Kiel)

Yuriy Gorodnichenko
(UC Berkeley & )

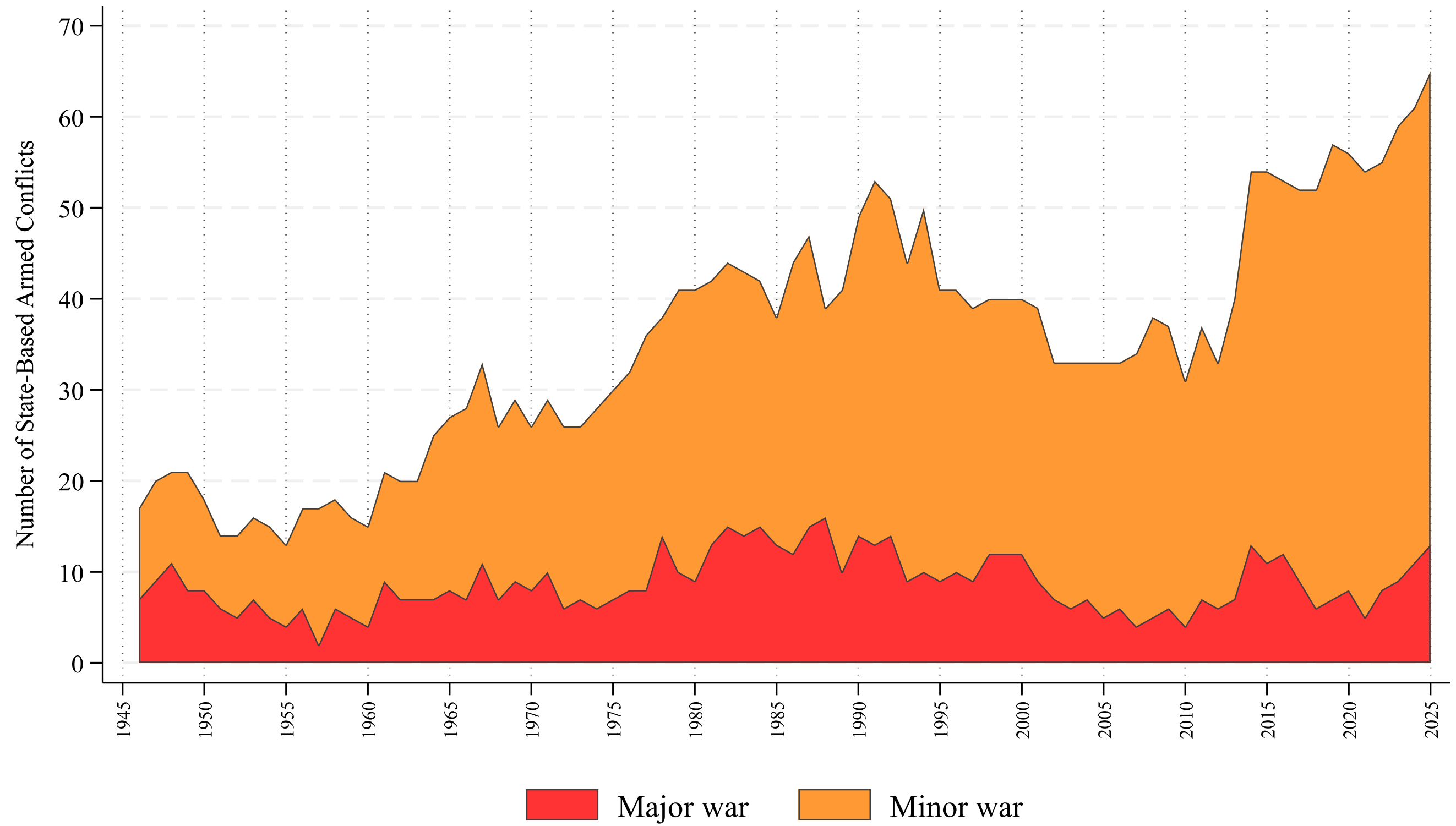
Oleksandr Talavera
(Birmingham & )

GEOPOLITICS IS BACK



A new era of geopolitical tensions; source: Caldara and Iacoviello (AER 2022).

NUMBER OF WARS



Tragic record: 65 wars in 2025; source: Uppsala Conflict Data Program

RUSSIAN AGGRESSION

The scale of destruction and atrocities not seen in Europe since World War II



Bucha, a suburb of Kyiv (sources: New York Times and Kyiv Independent)

The United Nations Human Rights High Commissioner (October 2022): “... the Commission documented patterns of **summary executions, unlawful confinement, torture, ill-treatment, and rape and other sexual violence** committed in areas occupied by Russian armed forces ...”

RUSSIAN AGGRESSION

2022: Ukraine's GDP: ↓ 30%, Unemployment rate: ↑ to 35%, Ukrainian refugees ≈ 9 million



WHY IS WAR SO ECONOMICALLY COSTLY?

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- Destruction of capital
- Destruction of labor
- Destruction of productivity

A VERY DIFFICULT QUESTION

- Big inter-state wars do not happen often

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- The median duration of a big inter-state war is short (≈ 1 year)
- Mostly fighting on the soil of small or less developed countries
- In most conflict settings, the statistical infrastructure collapses and so researchers must rely on
 - retrospective surveys
 - satellite imagery
 - fragmentary records reconstructed after the fact

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- A large, diversified economy
- Near-universal firm-level microdata available in almost real time with consistent reporting standards before and during the war (+ comparable data for peer countries)
- A massive, exogenous, and spatially heterogeneous shock
- Granular conflict intensity data

BASIC THEORY

- Efficient allocation of resources requires that marginal revenue products are equalized across firms, that is, for any firms i and j

$$MRPL_i = MRPL_j \text{ and } MRPK_i = MRPK_j$$

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$$MRPL_i = MRPL_j \text{ and } MRPK_i = MRPK_j$$

- $\text{var}(MRPL) > 0$ or $\text{var}(MRPK) > 0$ implies misallocation of resources.
- Under some assumptions (Hsieh & Klenow QJE 2009):

$$\begin{aligned} \log(TFP \text{ loss}) \\ = & -\frac{\alpha(1-\alpha) + \alpha(1+\alpha)\sigma}{2} \times \text{var}(\log(MRPK_{it}) - \log(MRPL_{it})) \\ & - \frac{\sigma(1+\alpha)}{2} \text{var}(\log(MRPL_{it})) + \frac{\sigma\alpha}{2} \text{var}(\log(MRPK_{it})) \end{aligned}$$

where $\alpha \approx$ the capital share in value added, σ is the elasticity of demand.

BASIC MEASUREMENT

- Marginal revenue product of capital or labor

$$MRPK = \underbrace{\alpha}_{\approx \text{capital share}} \frac{Y}{K}$$

$$MRPL = \underbrace{\beta}_{\approx \text{labor share}} \frac{Y}{L}$$

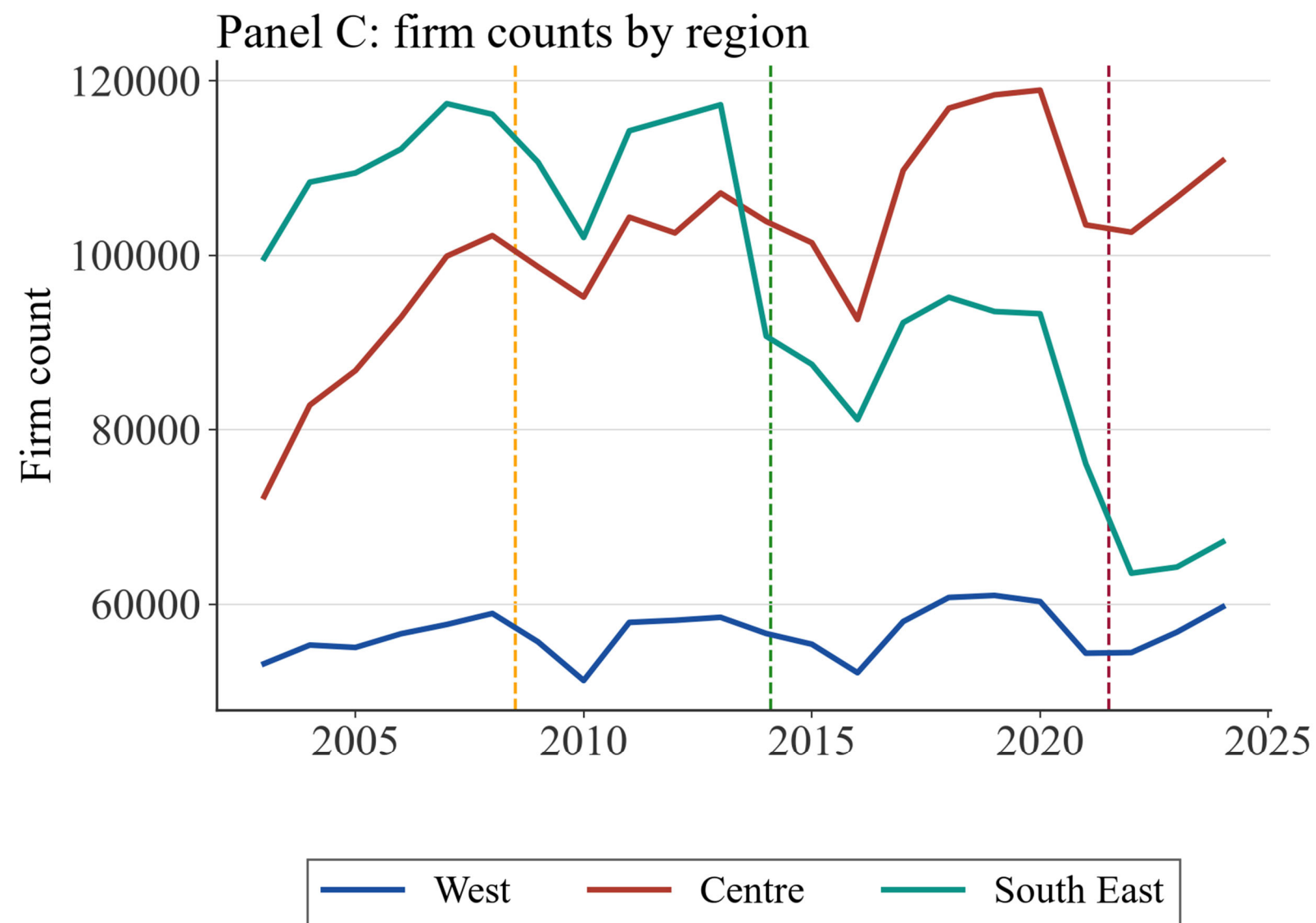
- Data sources:
 - ORBIS ($\approx$ universe of firms in Ukraine):
 - sales (Y)
 - capital stock (K)
 - employment (L)
 - Ukraine's Statistical Service, OECD: cost shares (α, β)

FIRM COUNTS AND ENTRY/EXIT

- Firm destruction is itself a first-order cost of war
- Understand selection

FIRM COUNTS AND ENTRY/EXIT

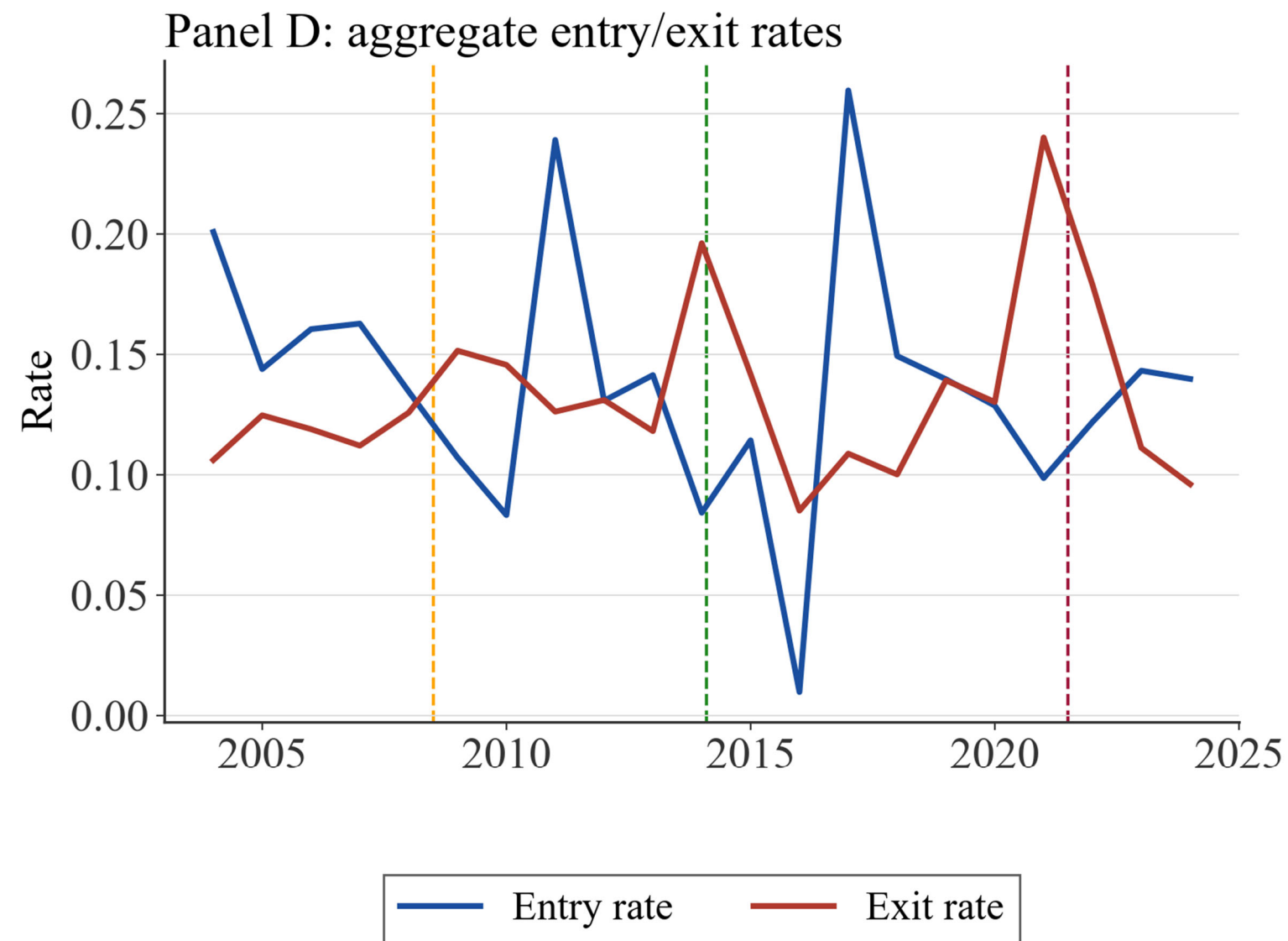
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A lot of exit...

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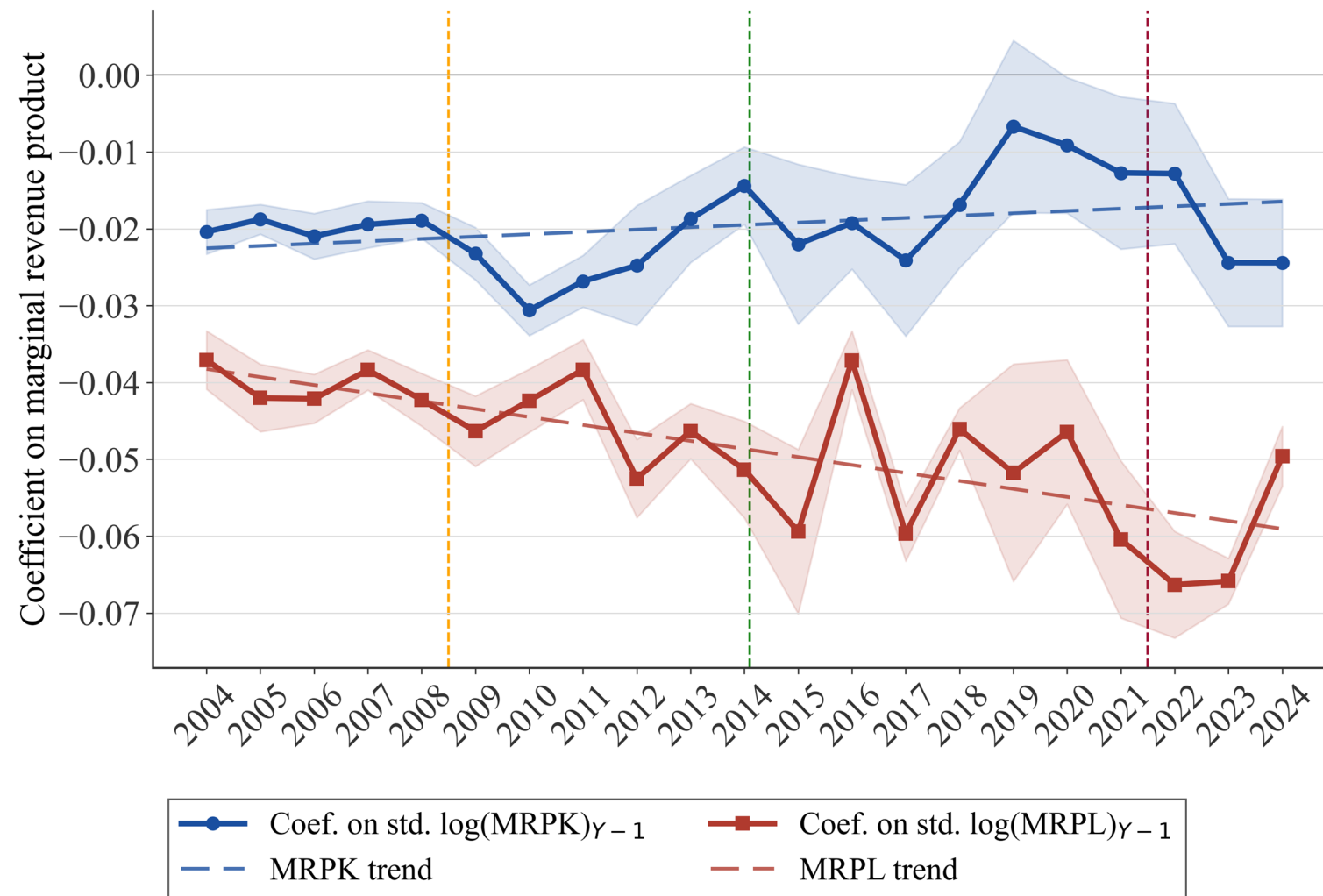


A lot of churn

FIRM COUNTS AND ENTRY/EXIT

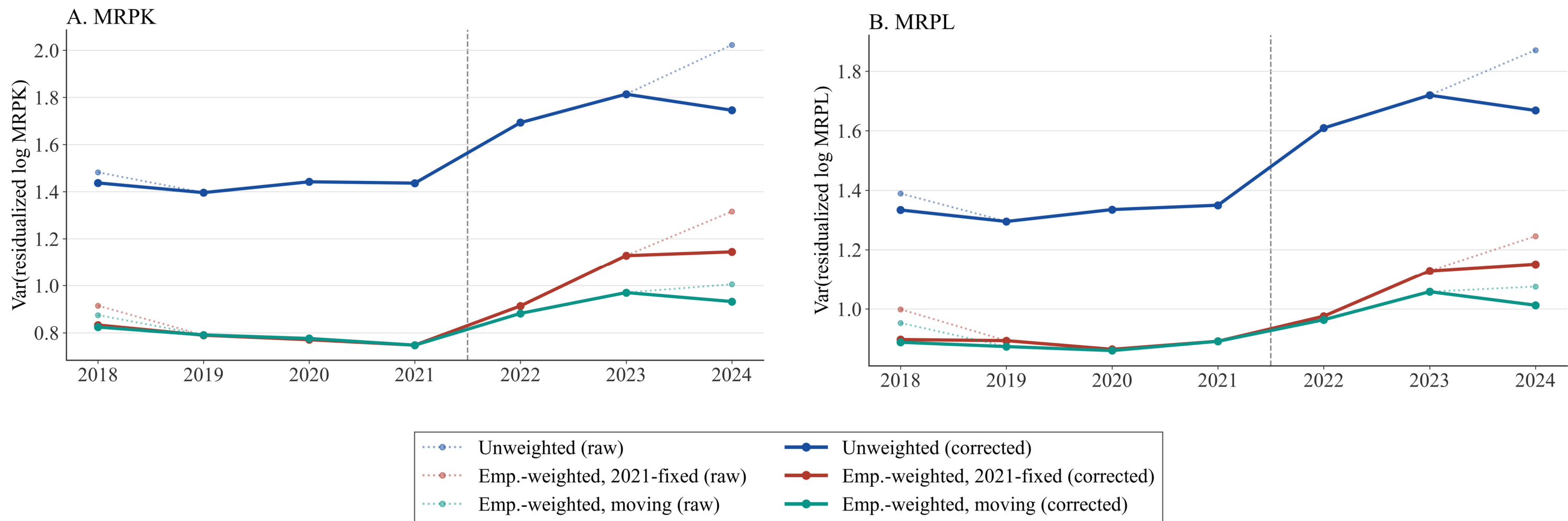
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Regress exit on marginal revenue product of labor or capital and plot coefficients



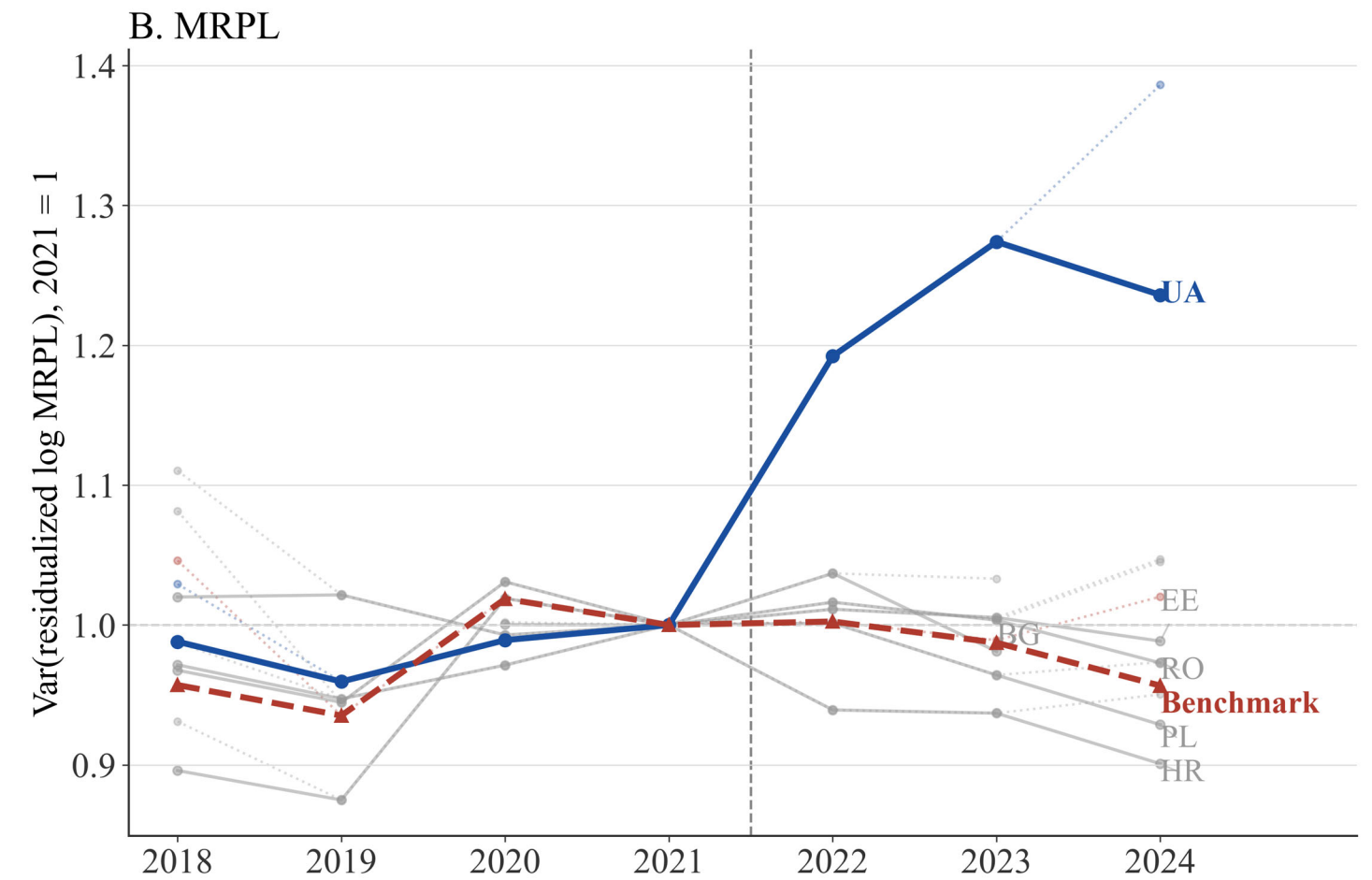
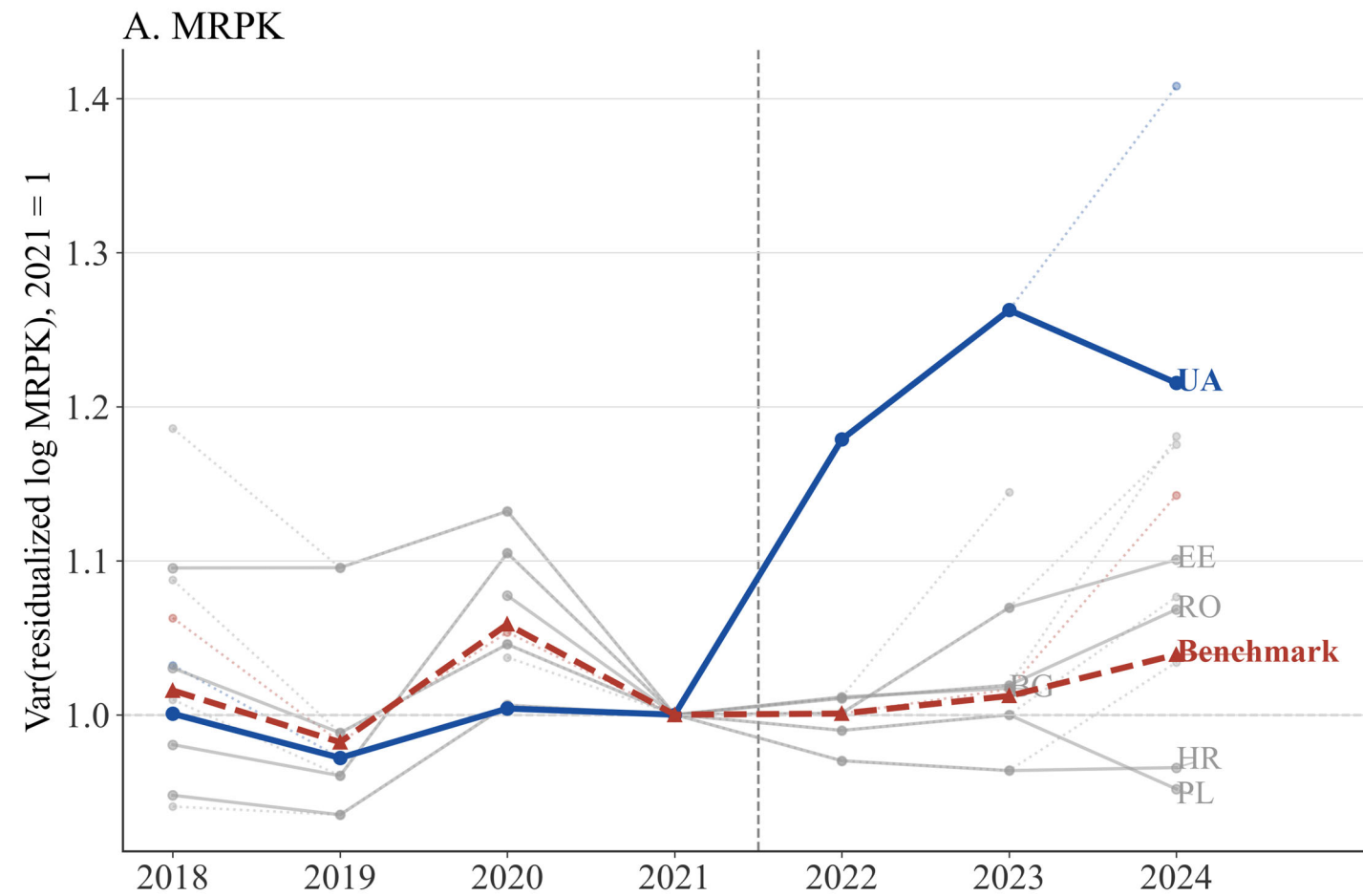
The war does not dramatically amplify Schumpeterian forces that cull the least efficient.

CROSS-SECTIONAL DISPERSION OF MRPK AND MRPL



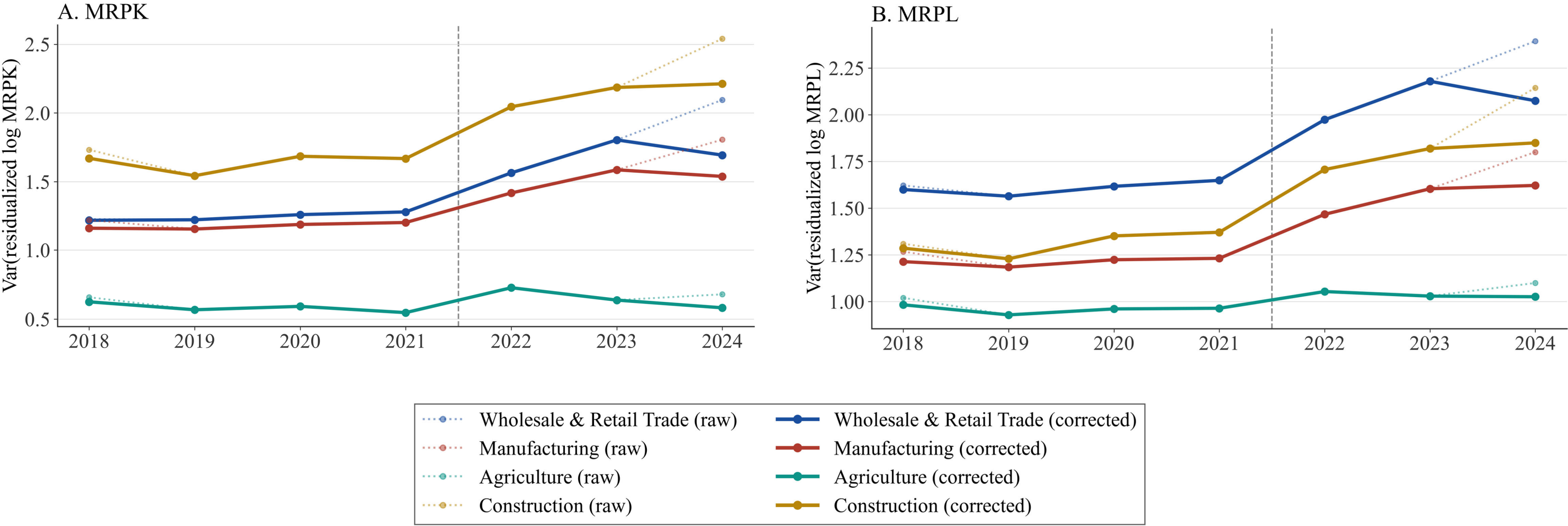
Big increase in dispersion for both marginal revenue products

CROSS-SECTIONAL DISPERSION OF MRPK AND MRPL



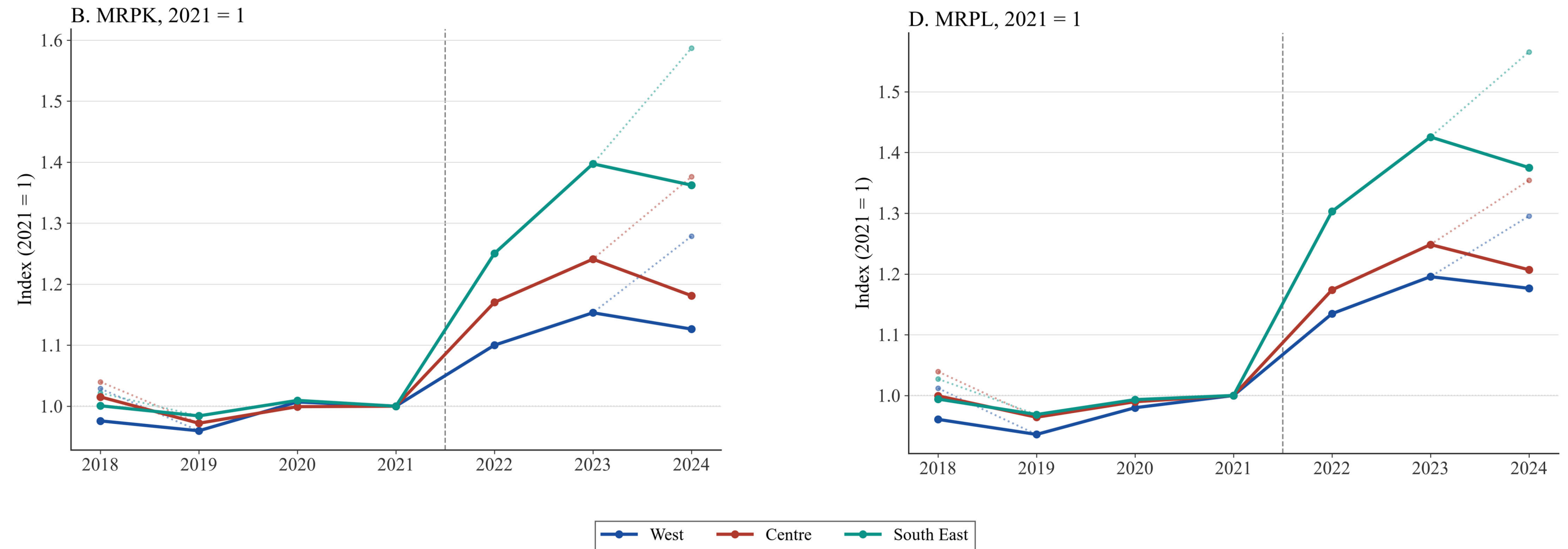
Ukraine stands out from peer countries in Eastern Europe $\Rightarrow$ dispersion $\uparrow$ is due to the invasion.

CROSS-SECTIONAL DISPERSION OF MRPK AND MRPL



Results are similar by sector but agriculture is more resilient (distributed production, does not rely on urban infrastructure, reopening of grain export corridors)

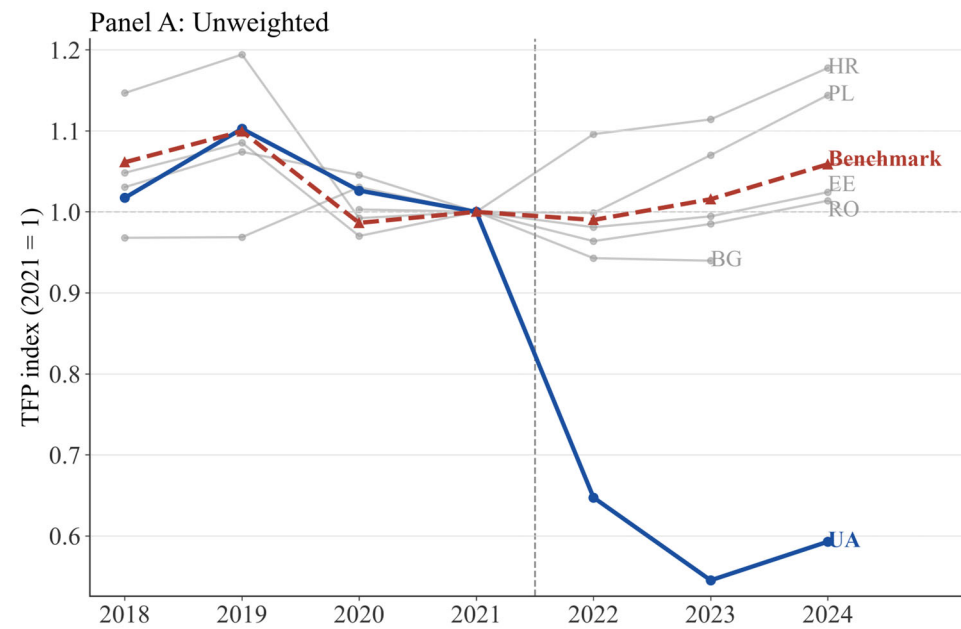
CROSS-SECTIONAL DISPERSION OF MRPK AND MRPL



Results are similar by macro-region but South-East is hit much harder

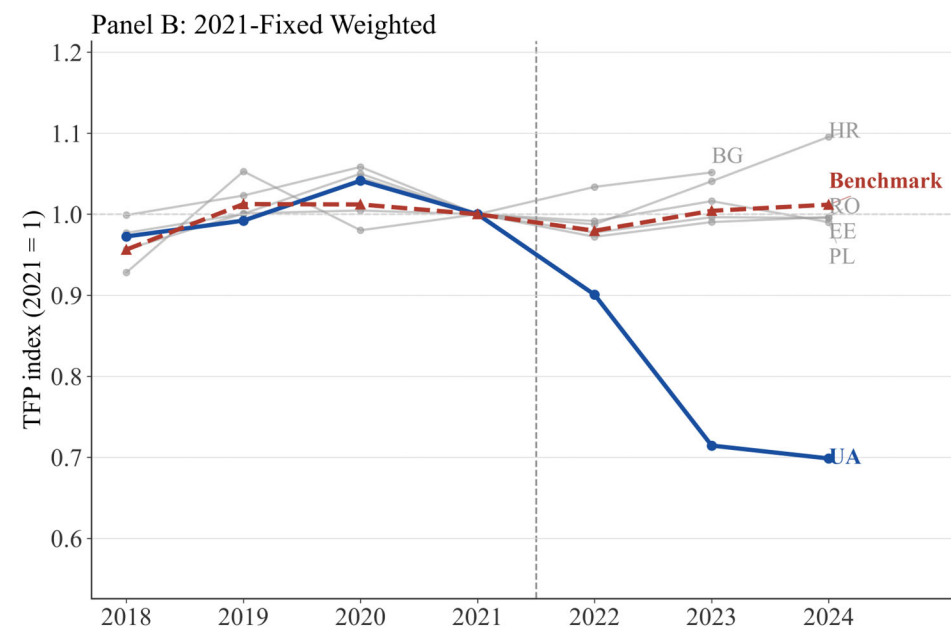
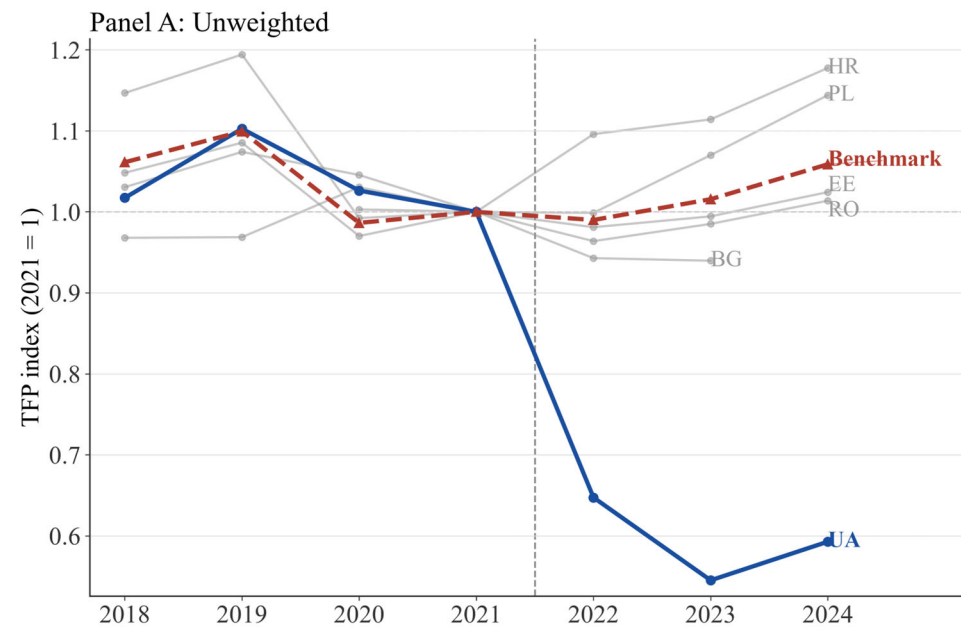
PRODUCTIVITY (TFP) LOSS

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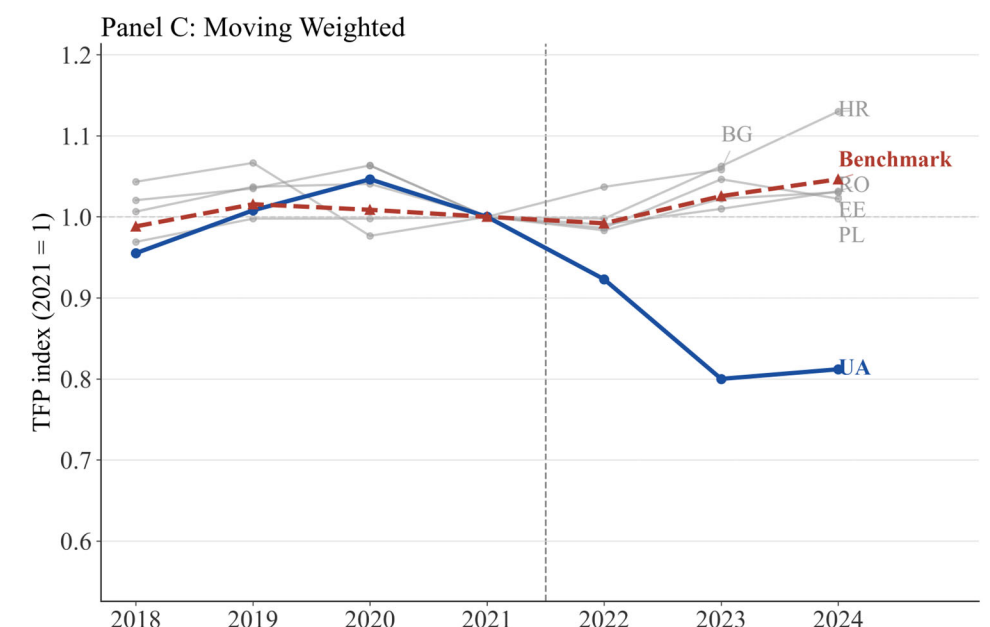
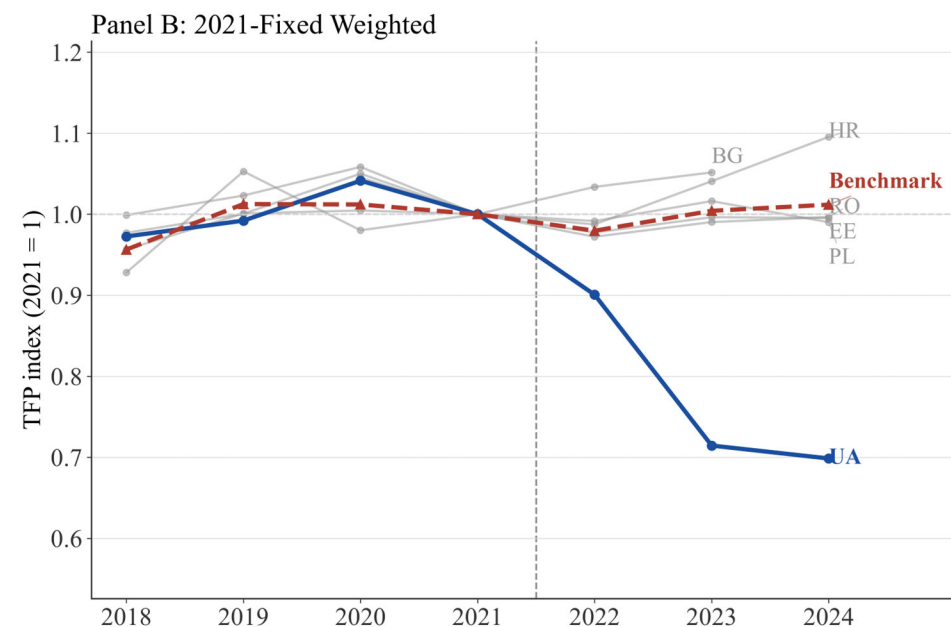
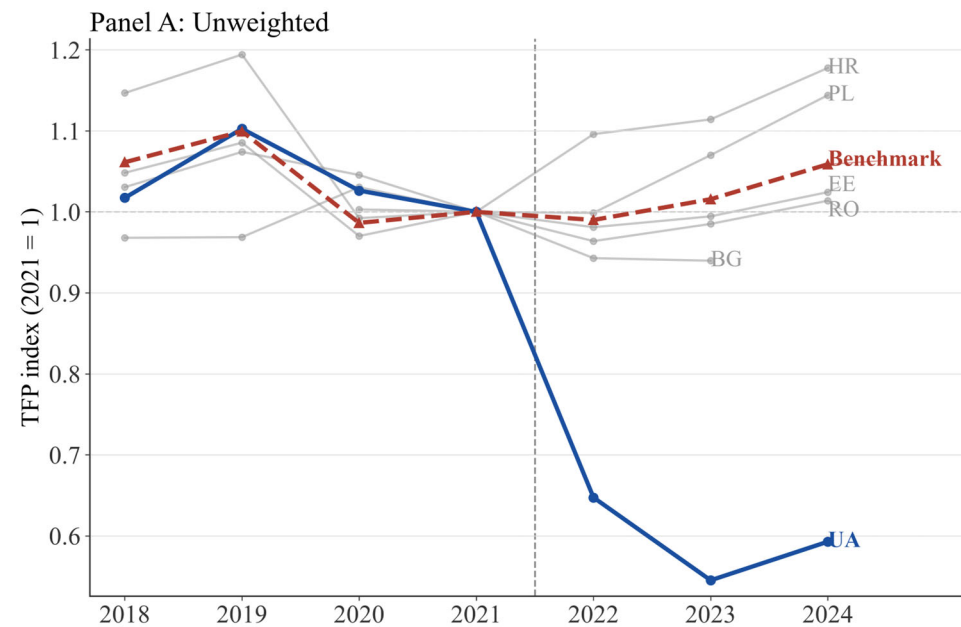
- If we use equal weights for all firms, there is a dramatic decline in allocative TFP.

PRODUCTIVITY (TFP) LOSS



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- If we use fixed employment weights from 2021, the decline is smaller but still large $\Rightarrow$ larger firms have greater capacity to cope with wartime challenges.

PRODUCTIVITY (TFP) LOSS



- If we use equal weights for all firms, there is a dramatic decline in allocative TFP.
- If we use fixed employment weights from 2021, the decline is smaller but still large $\Rightarrow$ larger firms have greater capacity to cope with wartime challenges.
- If we use moving employment weights, the decrease is even smaller but remains large $\Rightarrow$ the economy is adapting to the war by shifting resources.

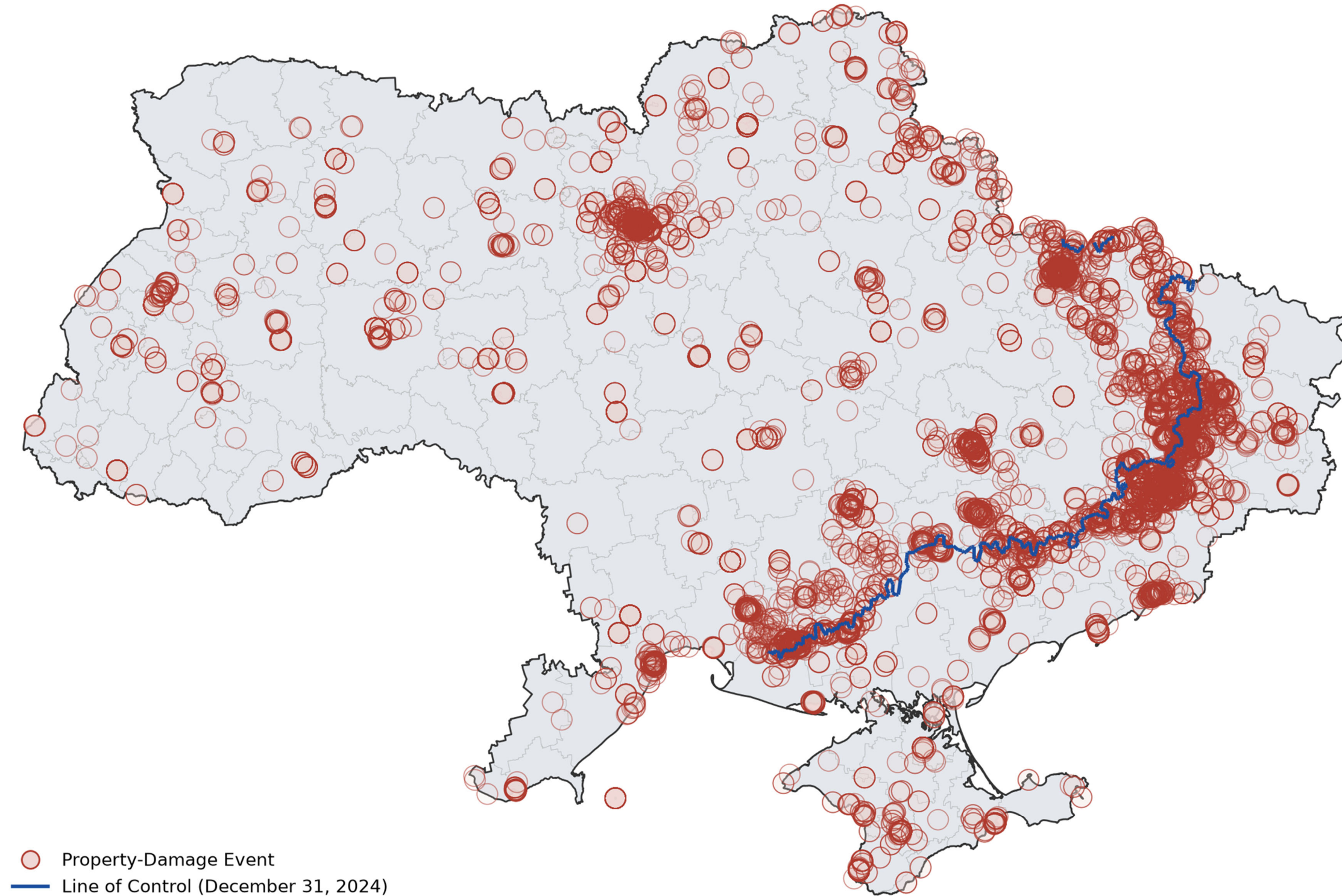
WHY IS WAR SO ECONOMICALLY COSTLY?

- Destruction of output (≈ 0.34 log points $\downarrow$)
- Destruction of capital (≈ 0.08 log points $\downarrow$)
- Destruction of labor (≈ 0.09 log points $\downarrow$)
- Destruction of productivity (≈ 0.17 log points $\downarrow$)

Half of the decline in output is due to allocative productivity loss

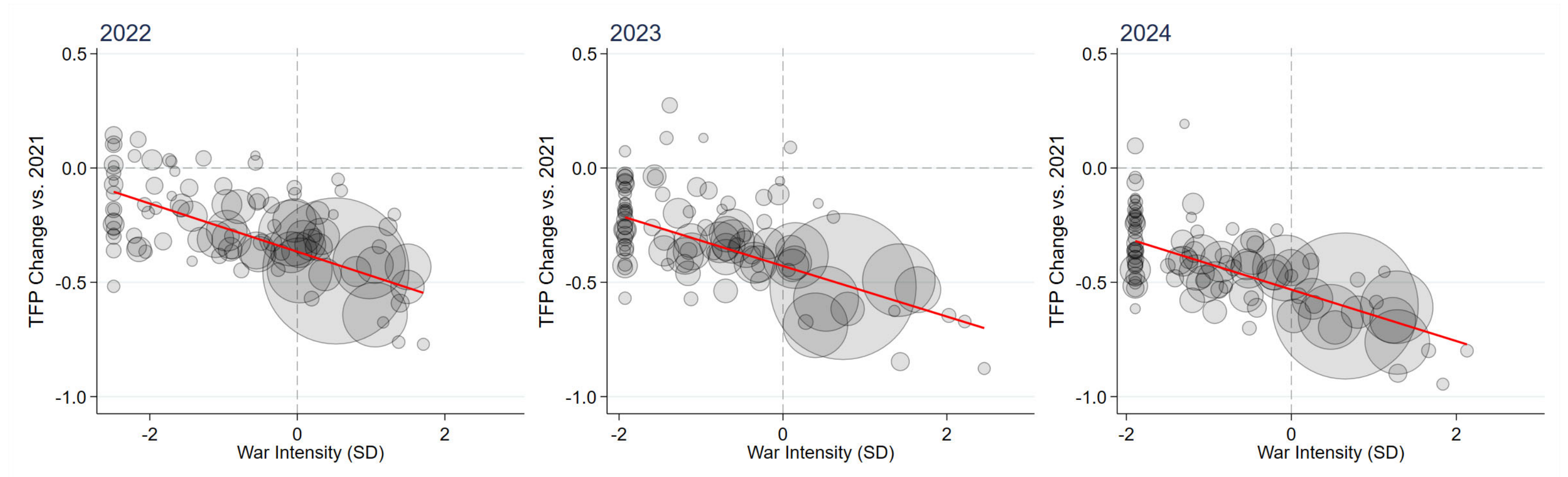
Our estimate of $\sim 20\%$ allocative TFP loss can rationalize the productivity residual in growth accounting.

SUBNATIONAL VARIATION: WAR INTENSITY



Source: Zhukov (JCE 2023)

SUBNATIONAL VARIATION: WAR INTENSITY VS. TFP LOSS



The size of each bubble shows the number of firms in a raion (district)

Further evidence pointing to war as a major driver of losses in allocative TFP

SUBNATIONAL VARIATION: DRIVERS OF TFP LOSS

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Dep.var.: TFP loss	(1)
War intensity	-11.0*** (1.1)
IDP inflow	
Liberation share	
R ²	0.63
# raion-years	288

1 standard deviation increase in war intensity lowers allocative TFP by 11 percentage points

Conditional on war intensity:

- Distance is not a strong predictor of TFP losses (Kyiv illustrates the point!)

SUBNATIONAL VARIATION: DRIVERS OF TFP LOSS

Dep.var.: TFP loss	(1)	(2)	(3)
War intensity	-11.0*** (1.1)		-11.1*** (1.1)
IDP inflow		-0.9 (1.6)	1.5* (0.9)
Liberation share			
R ²	0.63	0.05	0.55
# raion-years	288	191	191

1 standard deviation increase in war intensity lowers allocative TFP by 11 percentage points

Conditional on war intensity:

- Distance is not a strong predictor of TFP losses (Kyiv illustrates the point!)
- Larger inflows of IDPs are associated with higher TFP (helping to address shortages of labor)

SUBNATIONAL VARIATION: DRIVERS OF TFP LOSS

Dep.var.: TFP loss	(1)	(2)	(3)	(4)	(5)
War intensity	-11.0*** (1.1)		-11.1*** (1.1)		-10.2*** (1.1)
IDP inflow		-0.9 (1.6)	1.5* (0.9)		
Liberation share				-6.2*** (1.7)	-1.7 (1.2)
R ²	0.63	0.05	0.55	0.33	0.64
# raion-years	288	191	191	288	288

1 standard deviation increase in war intensity lowers allocative TFP by 11 percentage points

Conditional on war intensity:

- Distance is not a strong predictor of TFP losses (Kyiv illustrates the point!)
- Larger inflows of IDPs are associated with higher TFP (helping to address shortages of labor)
- Being under Russian occupation does not leave a significant “scar” on allocative TFP

SUBNATIONAL VARIATION: WAR INTENSITY VS. TFP LOSS

Adaptation			
Year	Moving weight	2021 fixed weight	Difference (pp)
2022	0.921	0.912	+0.9
2023	0.797	0.732	+6.5
2024	0.792	0.712	+8.1

Small difference in 2022: little reallocation occurred in the first year of the full-scale war
Larger differences in 2023 and 2024 point to adaptation

SUBNATIONAL VARIATION: WAR INTENSITY VS. TFP LOSS

Adaptation						
Year	Moving weight	2021 fixed weight	Difference (pp)	Between industry	Within raion	Between raion
2022	0.921	0.912	+0.9			
2023	0.797	0.732	+6.5	20.2%	57.7%	22.1%
2024	0.792	0.712	+8.1	19.9%	54.7%	25.4%

Small difference in 2022: little reallocation occurred in the first year of the full-scale war

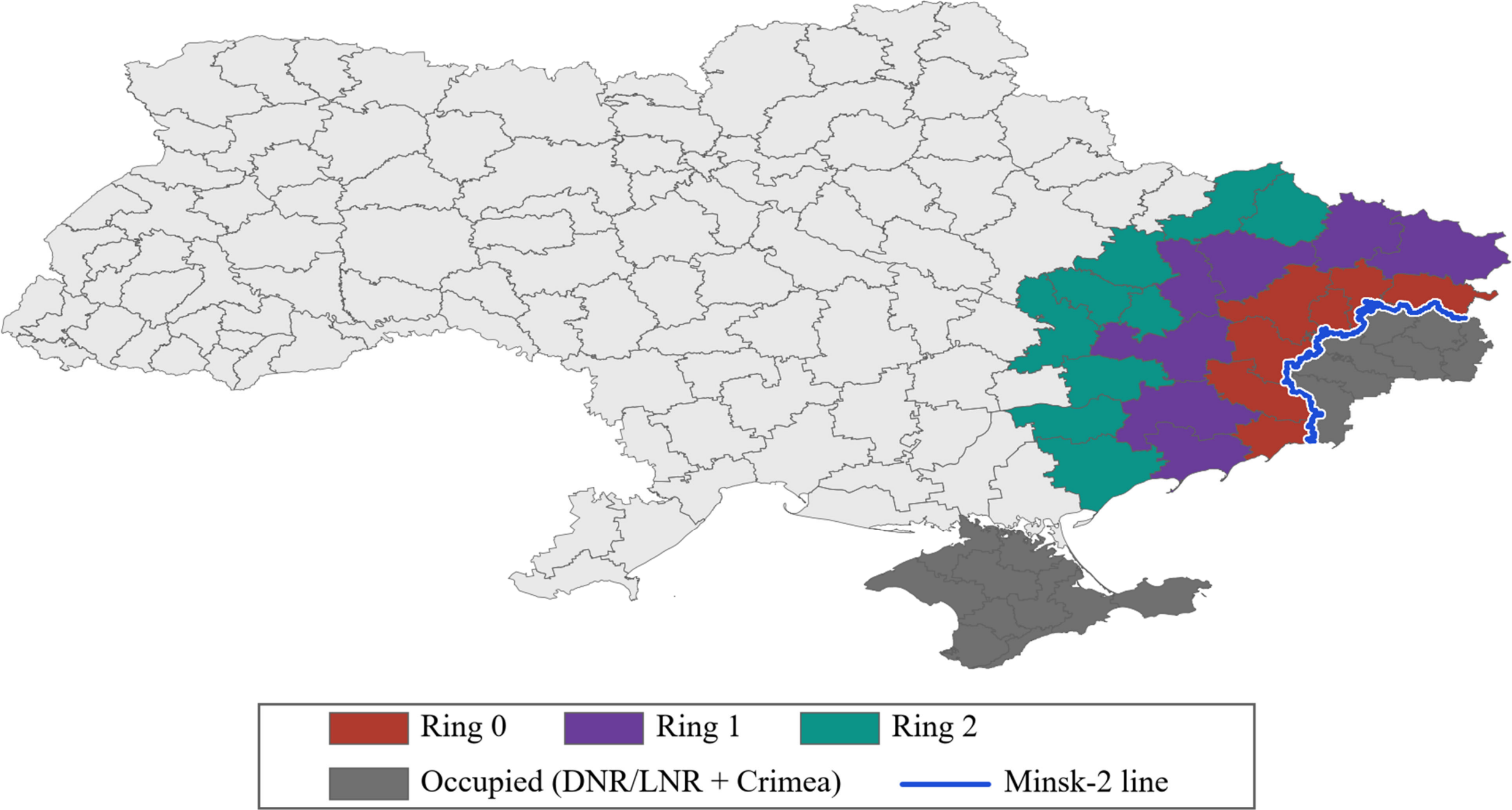
Larger differences in 2023 and 2024 point to adaptation

- One fifth of the adaptation is adjustment toward less war-vulnerable sectors
- Most of the adaptation is within raions, that is, firms and workers found workarounds locally
- Roughly a quarter of adaptation is via moving resources across raions

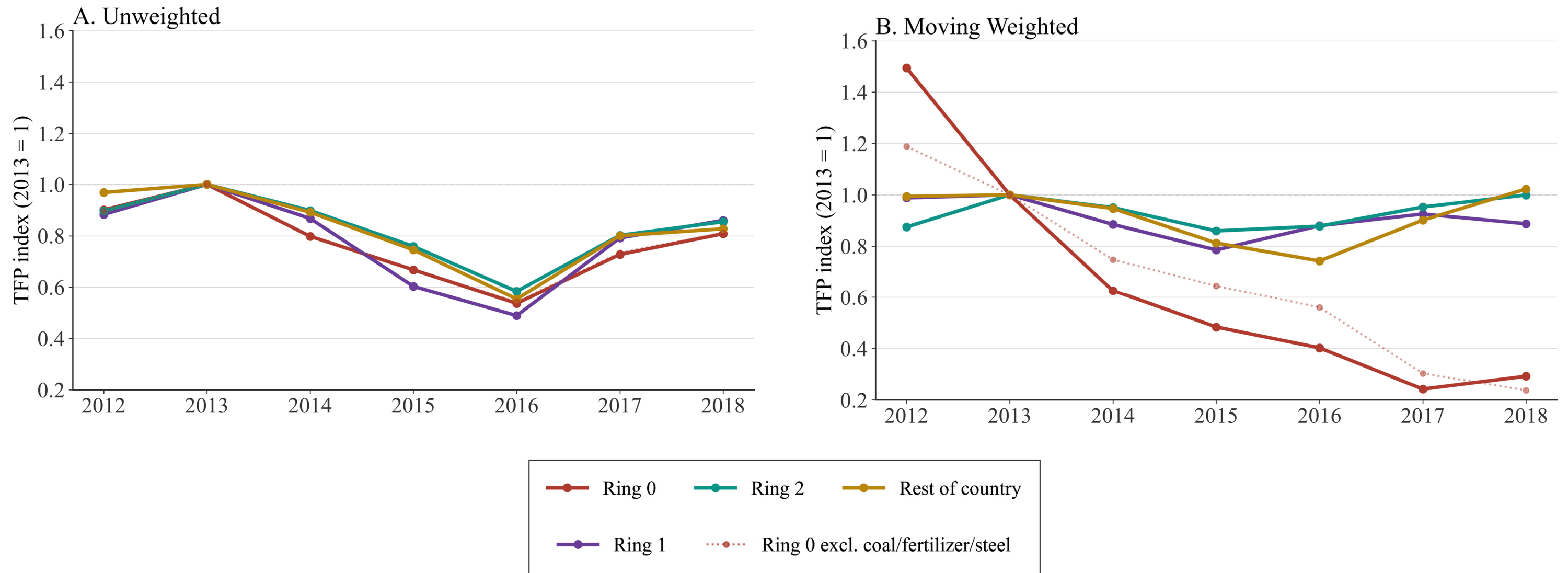
LESSONS FROM 2014 AND GLOBAL FINANCIAL CRISIS

	Military action	Macroeconomic landscape
2022: Full-scale invasion	Massive, prolonged	No banking crisis, no currency crisis, relatively modest inflation
2014: Crimea/Donbas	Geographically concentrated, relatively short	Banking crisis, currency crisis, high inflation
2008-2009: GFC	None	Banking crisis, currency crisis, somewhat high inflation

RUSSIAN AGGRESSION IN 2014

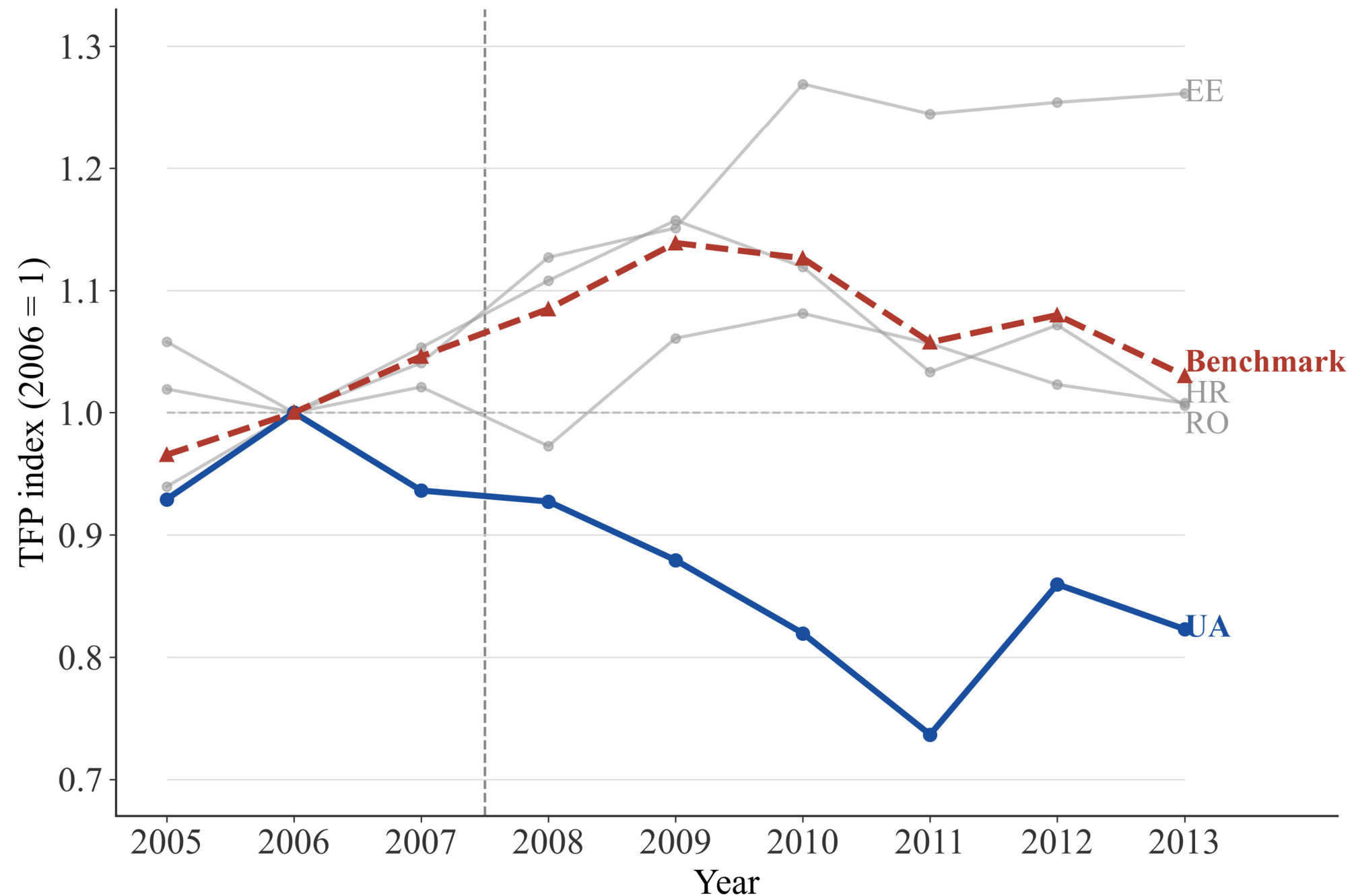


RUSSIAN AGGRESSION IN 2014



- Large, Soviet-legacy firms (steel mills, chemical plants, mines, etc.) were hit hard (IO linkages, disrupted access to markets, limited access to capital, direct shelling)
- Much weaker geographical ($\approx$ conflict intensity) gradient $\Rightarrow$ macro-level effects dominated (banking crisis, currency crisis, inflation, etc.)

GLOBAL FINANCIAL CRISIS 2008-2009



- Ukraine was hit hard (many crises, GDP collapsed by 20% in 2009Q1) but no military action
- “Slow burn” instead of concentrated collapse (zombie firms, related-party lending, NPLs)
- No geographical gradient

LESSONS FROM 2014 AND GFC

	Military action	Macroeconomic landscape	Cumulative TFP decline
2022: Full-scale invasion	Massive, prolonged	No banking crisis, no currency crisis, relatively modest inflation	20% to 40%
2014: Crimea/Donbas	Geographically concentrated, relatively short	Banking crisis, currency crisis, high inflation	20%
2008-2009: GFC	None	Banking crisis, currency crisis, somewhat high inflation	15%

- Maintaining macroeconomic and financial stability during a conflict is desirable for its own sake but is also critical for preventing allocative damage from compounding.
- The policy response and international assistance in 2022-2024 likely prevented an even greater decline in allocative TFP.

CONCLUDING REMARKS

A worker in Kharkiv still has his tools, his skills, and the will to work. Yet war has made him less productive not by destroying him, but by severing the links that make production possible. There are millions like him across Ukraine. That is the allocative cost of war.



Source: UNHCR

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Source: UNHCR

Some of the fastest gains in recovery will come not from new spending, but from better policy. To rebuild after war, it is not enough to replace what was lost; we must reconnect what remains.

CONCLUDING REMARKS

Europe's planners are preparing for attack by counting guns, aircraft, ammunition, and men. They are right to do so. But how many are counting the allocative damage—the economic dislocation that begins long before the last factory falls?



Source: NATO

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Europe's planners are preparing for attack by counting guns, aircraft, ammunition, and men. They are right to do so. But how many are counting the allocative damage—the economic dislocation that begins long before the last factory falls?



Source: NATO

Economic preparedness should encompass not only defense spending and strategic reserves but also institutional arrangements that facilitate rapid reallocation in times of stress. If roughly half the economic cost of war reflects allocative damage, then pre-conflict investments in flexibility and resilience may yield extraordinarily high returns.

A BLUEPRINT FOR THE RECONSTRUCTION OF UKRAINE

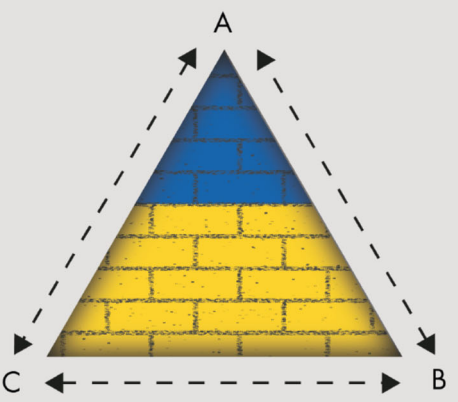
RAPID RESPONSE ECONOMICS 1

CEPR

PRESS

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Beatrice Weder di Mauro

MACROECONOMIC POLICIES



FOR WARTIME UKRAINE

RAPID RESPONSE ECONOMICS 2

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POST-WAR MACROECONOMIC



FRAMEWORK FOR UKRAINE

RAPID RESPONSE ECONOMICS 3

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PARIS REPORT 1

Rebuilding Ukraine: Principles and policies

Edited by
Yuriy Gorodnichenko, Ilona Sologoub, and Beatrice Weder di Mauro



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Ukraine's Reconstruction
Policy Options for Building an Effective Financial Architecture

Elena Carletti, Yuriy Gorodnichenko, Harold James, Jan-Pieter Krahnert, Vladyslav Rashkovan, Alexander Rodnyansky and Ilona Sologoub



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Europe 2050:
Geometries of Peace,
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CEPR

May 2026

The Wild East: Ukraine and the Remaking of Europe

Yuriy Gorodnichenko
University of California, Berkeley and CEPR

To ensure timely dissemination, the "Europe 2050" papers are published without editing or typesetting. These contributions will subsequently form the basis of CEPR Paris Report 5, to be published at a later stage and edited by Olivier Blanchard, Pascal Lamy, Enrico Letta, and Beatrice Weder di Mauro.

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PRESS



Edited by Yuriy Gorodnichenko and Vladyslav Rashkovan

Supporting Ukraine: More critical than ever

CENTRE FOR ECONOMIC POLICY RESEARCH

CEPR

June 2024

Stimulating growth in Ukraine and policies for migrants' return

Vjaceslavs Dombrovskis, Maurice Obstfeld, Ilona Sologoub, Yuriy Gorodnichenko, Torbjorn Becker, Anastassia Fedyk, Gerard Roland and Beatrice Weder di Mauro¹

EXECUTIVE SUMMARY

As a protracted war of attrition seems increasingly likely, Ukraine's economic resilience becomes critical to sustaining its defensive capabilities and national endurance. To defeat the Russian aggression, Ukraine must not only keep its economy running, but also raise its productive capacity to finance its army, boost military output, support the population, and encourage refugees to return.

We propose creating **fortified economic clusters** in the relatively safer regions of western and southwestern Ukraine, shielded by geographical distance and enhanced with modern air defence systems. Investment in these clusters will be secured through comprehensive war insurance policies and bolstered by reliable supplies of energy and raw materials, ensuring uninterrupted production. To attract capital to these areas, Ukraine can rely on a combination of domestic private investment and foreign direct investment (FDI) that has the European Union and other external markets as destinations for output.

Key infrastructure improvements, such as the **extension of the standard European railroad gauge into Ukraine**, will integrate these clusters with European markets, maximising export potential and attracting both domestic and foreign direct investments.

Outside the safety clusters, we advocate for a **decentralised production strategy**, focusing on adaptable sectors such as agriculture and information services. In regions closer to the frontline, solutions such as underground production and social facilities can be used.

In parallel, we propose **strategic human resource initiatives** to improve labour allocation. Workers will be directed towards the fortified economic clusters and supported with affordable housing options to facilitate their relocation. To address the skill mismatches and shortages, intensified collaborations between businesses, educational institutions, and job placement services are recommended. The government shall play a crucial role in engaging marginally attached workforce segments by offering in-person schooling, retraining programmes, and public works, thereby enhancing formal labour participation. Organisations of internally displaced people (IDPs) will be essential partners in these initiatives.

CEPR POLICY INSIGHT No. 52

1 The full list of contributing authors appears at the end of this Policy Insight.