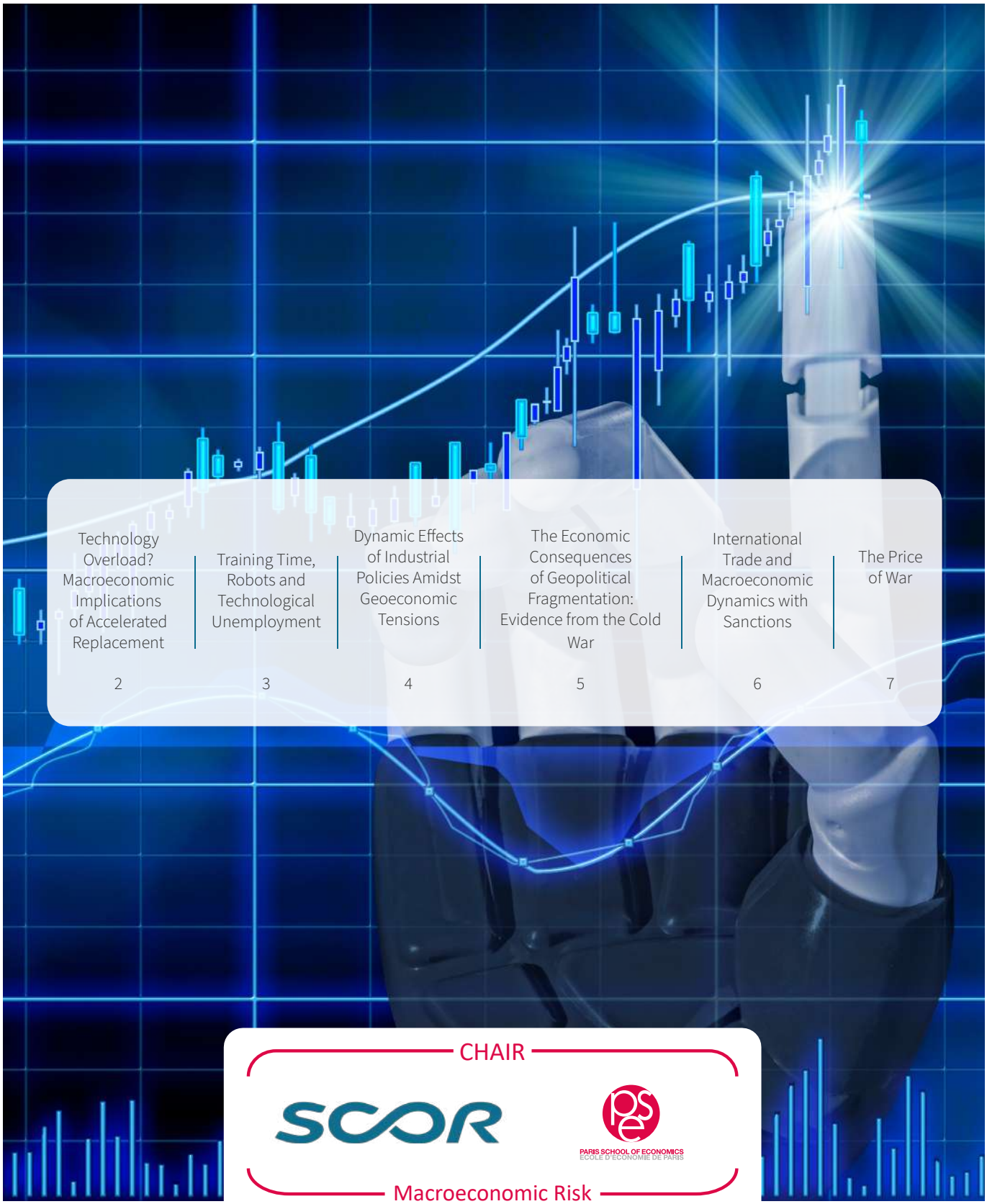
MACROECONOMIC RISK CHAIR
NEWSLETTER N°16

The seventh annual conference of the Macroeconomic Risk Chair was held at the Paris School of Economics on September 19th, 2024 on the topic "New risks and their implications for macroeconomic performance and policy". Several influential economists participated to present their most recent research on macroeconomic risk.

This newsletter includes **a brief description of the research papers discussed at the conference**.



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Macroeconomic Risk

Technology Overload? Macroeconomic Implications of Accelerated Replacement

Seda Basihos (University of Cambridge)

Technology Overload? Macroeconomic Implications of Accelerated Replacement, Working Paper, April 2024.

In 1987, Robert Solow famously remarked: "You can see the computer age everywhere but in the productivity statistics." Despite technological progress and the widespread adoption of computing across industries, productivity growth has slowed over the past decade. While average productivity growth in the United States was 2.7% between 1996 and 2005, it declined to 1.4% between 2006 and 2018. At the same time, there has been a secular decline in the labor share, from 65% in 1970 to 57% in 2020. **Why has the adoption of technology not translated into higher productivity growth, and is there a connection between this trend and the decline in the labor share?**

This paper by Seda Basihos addresses these questions by introducing a key concept: the rate of technology replacement, defined as the rate at which existing technology is replaced by newer technologies. Using US firm-level data from 1970 to 2018, she identifies large-scale, lumpy investment spikes that may indicate instances of technology replacement. The analysis reveals a clear break in the rate of new technology adoption: while the rate was constant at an average of 5.2% between 1970 and 1995, it increased to 7.8% between 2006 and 2018 - a 50% rise. However, the paper argues that this accelerated pace of technological adoption does not necessarily translate into greater efficiency. First, new technologies render older ones obsolete, meaning that the stock of efficient capital is not the sum of old and new capital, but rather the sum of new capital and the portion of old capital that has not yet become obsolete. Second, it takes time for workers to learn how to effectively use new technologies, resulting in suboptimal productivity for several years after their introduction.

To quantify these effects, the author develops an endogenous growth model with directed capital change. In the model, production relies on both efficient labor and efficient capital, with growth driven by new technology and the exogenous technology replacement rate, as newer technologies render older ones obsolete. Efficient labor growth, in contrast, depends on skill investments, which take longer to accumulate. The main experiment simulates the observed rise in the technology replacement rate (from 5.2% to 7.8%), resulting in **a decrease in the equilibrium growth rate from 1.66% to 1.47% and a decline in the labor income share from 63% to 56%**. When comparing the model's outcomes with the data, it explains 70% of the observed slowdown in growth and fully accounts for the decline in the labor share.

The model thus explains the paradox of slowing productivity growth despite faster technology adoption through the following mechanism: as it takes time for workers to learn to use new technology effectively, the efficiency of capital remains permanently below its potential when technology is replaced too frequently. Since labor and capital are complementary, and labor skills adapt more slowly, reduced capital efficiency hinders the accumulation of efficient labor. This leads to capital-biased resource reallocation, reduced investment in skill accumulation, and ultimately, slower growth. Therefore, the "technology overload" mechanism unifies the decline in both productivity growth and the labor share within a single theoretical framework. The key factor is the technology replacement rate: machines tend to become prematurely obsolete while still productive, and workers cannot adapt quickly enough to use new technologies efficiently.

Training Time, Robots and Technological Unemployment

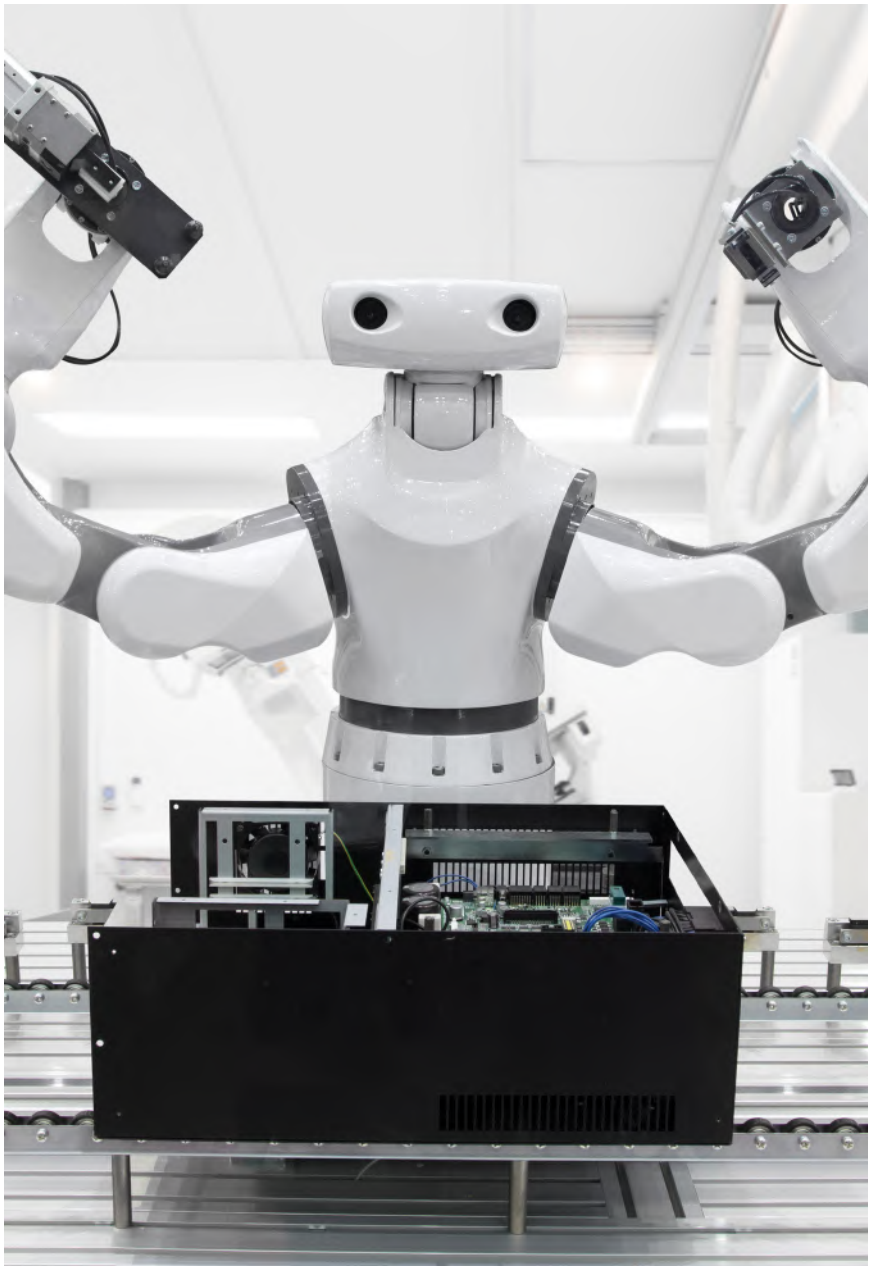
Fenicia Cossu (University of Cagliari), **Alessio Moro** (University of Cagliari and CEPR) and Michelle Rendall (Monash University and CEPR)
Training Time, Robots and Technological Unemployment, Working Paper, August 2024.

In 2022, Artificial Intelligence (AI) was able to write stories with a simple prompt; by 2023, it could generate images, and by 2024, it could create movies. In some industries, this rapid technological advancement may lead to massive layoffs, as robots and AI are cheaper than human labor. **Will AI replace jobs and trigger an unprecedented rise in unemployment?** Moreover, will we witness a growing gap between high-skilled workers, who become more productive with new technology, and low-skilled workers, who are replaced by it? Historically, large-scale automation in primary and secondary sectors has not increased unemployment, as workers shifted to the tertiary sector. Will AI differ from previous forms of capital in this regard?

This paper addresses these questions by introducing the concept of "technological unemployment", which refers to job losses caused by technological change. This rise in unemployment can be either structural, if the occupational structure is permanently altered and fewer workers are needed, or frictional during the transition, if barriers exist to the reallocation of workers across occupations. The authors focus on the second scenario, providing evidence that **the average training time** (beyond compulsory 12-year education) **required to perform an occupation increased from 8.3 years in 2006 to 9.0 years in 2019**. This increase is driven entirely by high-skilled workers, who are concentrated in expanding sectors, making it more difficult for workers from shrinking sectors to shift into these fields. This suggests that AI may differ from previous types of capital: while learning to operate a tractor was relatively straightforward, mastering computers took longer, and learning to use AI-powered technologies will likely take even more time.

In his paper coauthored with Fenicia Cossu and Michelle Rendall, Alessio Moro then develops a quantitative model to estimate the effects of technological change on unemployment. A key feature of the model is the decomposition of occupations into multiple tasks, some that can only be done by workers and others that can be done by either workers or robots, with robots being the cheaper option. For each task, workers choose between investing time in training or working; the opportunity cost of training is the wage foregone, while the opportunity cost of working is the increased likelihood of being replaced by a machine. In this framework, the authors introduce an unexpected technological shock that increases the number of tasks robots can perform or enhances robot productivity. As the marginal product of labor declines, **workers must be reallocated, which is costly and requires training, creating a barrier to switching occupations and resulting in higher unemployment** at the new steady state. However, early in the transition, unemployment may initially be lower as trained unemployed people join high-skill sectors before low-skill workers exit their occupations.

In conclusion, this paper quantifies the impact of AI-driven technological change on unemployment. As sectors employing high-skilled workers expand and the time required to learn new technologies increases, these frictions lead to higher unemployment at the new steady state and reshape the occupational structure during the transition.



Dynamic Effects of Industrial Policies Amidst Geoeconomic Tensions

Ziran Ding (Bank of Lithuania and Kaunas Univ. of Technology), **Adam Hal Spencer** (University of Bonn) and Zinan Wang (Tianjin University)
Dynamic Effects of Industrial Policies Amidst Geoeconomic Tensions, Working Paper, 2024.

After decades of expanding globalization, political winds have shifted, driven by concerns over de-industrialization, climate transition, and the global financial crisis. This backlash against globalization has been further intensified by the US-China trade war, the Covid-19 pandemic, and Russia's war against Ukraine. In response, many regions are implementing industrial policies, such as raising import tariffs, erecting barriers to global value chains, and providing subsidies for domestic production. These policies often trigger retaliatory measures, making it essential to account for strategic interactions and dynamic evaluations in economic analysis. **What are the effects of industrial policies on local and foreign production?** If some policies provide short-term benefits but long-term costs, what is the optimal policy depending on the time horizon of the policymaker? Furthermore, how do these policies affect different groups of workers, particularly those more vulnerable to offshoring?

To address these questions, Adam Hal Spencer, together with coauthors Ziran Ding and Zinan Wang, develops a dynamic general equilibrium model of an open economy, featuring rich interactions between two countries, which can be interpreted as the North and South (or the US and China). A key feature of the model is the inclusion of two types of workers: low-skilled and high-skilled, both essential in production but unevenly distributed across the two economies. The South has a larger share of low-skilled workers, while the North has more high-skilled workers. Firms, facing this labor distribution, make endogenous decisions on whether to hire locally or offshore tasks: the North may offshore low-skilled tasks, while the South offshores high-skilled tasks. Additionally, firms face fixed costs for market entry and offshoring, and are heterogeneous in productivity, meaning only the most productive firms choose to offshore. Firms also decide whether to sell locally or export, making production dependent on more than just local demand.

In the model, the authors compare the transitional effects of a 1% temporary shock to four different industrial policies in the North: import tariffs, offshoring frictions, domestic production subsidies, and entry subsidies. Focusing on the two most quantitatively relevant policies —import tariffs and production subsidies— the findings show that **the welfare impact depends critically on the time horizon considered**. On the one hand, production subsidies have larger short-term effects. These subsidies depress market entry by favoring incumbent firms, reallocating resources from entry investment to production. This boosts labor demand and wages, leading to higher consumption in the North and welfare gains of 0.2% and 0.04% at one- and four-year horizons, respectively. However, in the long run, the reduced entry of new firms leads to an overall welfare loss. On the other hand, import tariffs increase the cost of low-skilled labor in the North, reducing firm profits and causing short-term welfare losses. Yet, in the long term, the positive effects on firm creation outweigh the initial costs, resulting in overall welfare gains for the tariff-imposing country. Consequently, the optimal policy depends on the policymaker's horizon: **if the focus is on short-term gains—perhaps for re-election—production subsidies are more attractive, whereas in the long run, tariffs are preferable**.

Finally, considering the retaliatory nature of industrial policies, the authors examine the strategic interaction between the two countries, analyzing each country's optimal response to the other's policy. In the short run, imposing production subsidies is the dominant strategy for both the North and South, yielding welfare gains for both. However, in the long run, both countries experience welfare losses. This suggests that, despite the short-term benefits, laissez-faire remains the best long-term strategy. Yet, as in a prisoner's dilemma, this strategy is unlikely to be stable if policymakers prioritize short-term outcomes.

The Economic Consequences of Geopolitical Fragmentation: Evidence from the Cold War

Rodolfo G. Campos (Banco de España), Benedikt Heid (Universitat Jaume I) and Jacopo Timini (Banco de España)
The Economic Consequences of Geopolitical Fragmentation: Evidence from the Cold War, Working Paper, April 2024.

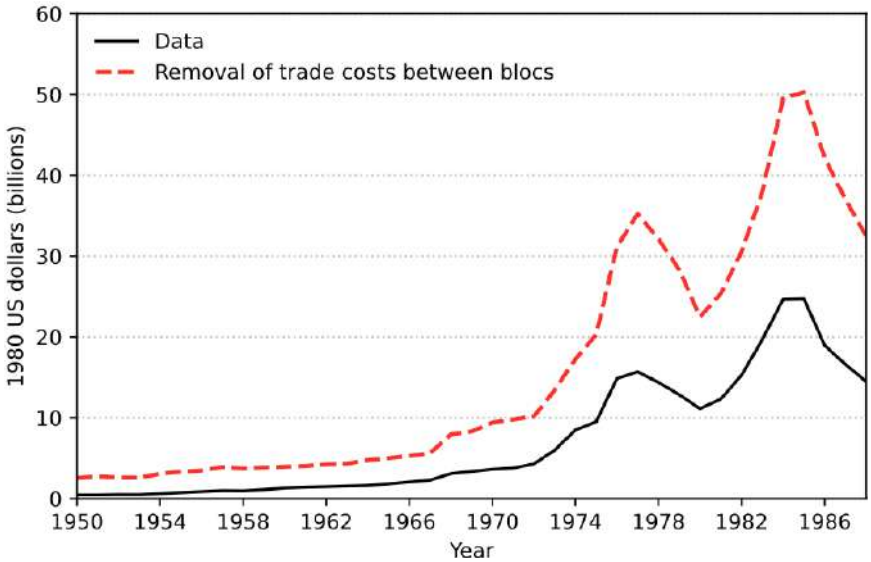
As geopolitical fragmentation intensifies, - illustrated by the US-China trade war, Russia's invasion of Ukraine, and, more broadly, the political backlash against globalization - it is essential to assess its economic implications. Historical precedents can offer valuable insights, with the Cold War and the Iron Curtain between the East and West blocs standing out as prime examples of political, military, and cultural barriers to trade. How significant were these barriers? Were they constant throughout the Cold War? And what would global trade have looked like in their absence?

This paper makes two primary contributions. First, the authors augment existing trade datasets with new primary sources, enabling them to estimate Cold War trade barriers. Second, they propose a quantitative model to conduct a counterfactual analysis of what global trade might have been without the Iron Curtain. The authors address the well-known challenges of historical trade data, which are often incomplete or inaccurate, as trading with the opposing bloc was politically sensitive during the Cold War. To overcome this, they digitize statistical yearbooks from Eastern bloc countries, drawing on sources from East Germany and the USSR, thereby complementing existing data for the Western bloc. Using these enriched data, they estimate a structural gravity model of bilateral trade flows for all countries during the Cold War. Importantly, their estimation is time-varying, reflecting the possibility that the intensity of the Iron Curtain fluctuated over time. The estimated coefficients are transformed into tariff-equivalent measures, providing an economically interpretable metric. Their findings suggest that **the tariff-equivalent measure of the Iron Curtain peaked at 45% and declined to 25% by the end of the Cold War**. Interestingly, the estimates reveal a negative tariff for intra-bloc trade (East-East and West-West), implying that the Iron Curtain acted as a trade subsidy within each bloc.

The empirical analysis is complemented by a counterfactual exercise, where the authors employ a static general equilibrium trade model to simulate a world with and without the estimated trade barriers. Key features of the model include high trade elasticity (how bilateral trade flows respond to a change in bilateral trade cost) and positive supply elasticity (how output in a country reacts to an increase in the relative price of its export goods). The model is calibrated for each year of the Cold War, with and without the tariff estimated in the empirical part. Despite the gradual easing of trade restrictions, the authors find that **the Iron Curtain halved East-West trade flows and caused significant welfare losses in Eastern bloc countries**, which persisted until the end of the Cold War. In contrast, Western countries experienced smaller welfare losses, as the Iron Curtain fostered intra-bloc trade.

In conclusion, this paper provides new insights into the trade costs of geopolitical fragmentation by quantifying the welfare losses associated with the Cold War. By enriching existing datasets with new primary sources, the authors estimate a substantial, though decreasing, reduction in trade due to the Iron Curtain. Their counterfactual analysis suggests a tariff-equivalent of 48% at the peak of the Iron Curtain in 1951. These findings are particularly relevant in the context of current rising geopolitical tensions.

Trade flows between East and West with and without the Iron Curtain



International Trade and Macroeconomic Dynamics with Sanctions

Galip Kemal Ozhan (International Monetary Fund), Fabio Ghironi (University of Washington) and Daisoon Kim (North Carolina State Univ.)
International Trade and Macroeconomic Dynamics with Sanctions, Working Paper, March 2024.

Trade sanctions are a common tool used by major economies in response to geopolitical tensions. These sanctions typically target smaller countries, imposing high costs on the sanctioned country while having a relatively minor impact on the sanctioning country. However, the case of sanctions against Russia following its invasion of Ukraine is different, as Russia is a major economy, particularly in gas exports, on which many countries heavily depend. Given the high level of global economic integration, the effects of such sanctions are amplified and can be difficult to analyze, especially when third countries divert trade flows.

This paper examines the macroeconomic consequences of sanctions between two large economies using a micro-founded model of international trade and macroeconomic dynamics. The model features two countries, "Home" and "Foreign", designed to represent the coalition of 38 sanctioning countries and Russia, respectively. The countries share some structural similarities: both have domestic gas producers, firms producing final goods with gas inputs for export, and households that consume goods and trade bonds internationally. However, they differ in three key ways. First, **their comparative advantages differ: the Home country is more efficient in producing consumption goods, while the Foreign country is more efficient in gas production.** Second, the Home country has lower gas endowments, making it dependent on gas imports from the Foreign country. Finally, the Foreign country maintains a positive net foreign asset position, reflecting long-term imbalances in capital flows.

The authors introduce three types of sanctions into this calibrated model. First, financial sanctions restrict a portion of Foreign agents from participating in the international bond market. Second, trade sanctions limit the ability of both Foreign and Home firms to export by imposing a productivity ceiling that prevents the most productive firms from accessing international markets. Finally, gas sanctions prohibit the import of gas from the Foreign country.

For each type of sanction, the authors compute the welfare changes for both the sanctioned and sanctioning economies. Both countries suffer welfare losses as sanctions force them to reallocate resources to sectors where they are less efficient, leading to misallocation. However, the magnitude of these losses varies by sanction type. Under gas sanctions, the Home country experiences a welfare loss of 2.2%, larger than the Foreign country's 0.8% loss, as the Foreign country shifts resources towards producing differentiated goods, mitigating some of the income and export revenue losses. Conversely, trade sanctions impose a larger cost on the Foreign country, which faces a 7.3% welfare loss compared to 4.5% for the Home country, as the latter can still leverage external demand for its consumption goods. Thus, **gas sanctions are more costly for the Home country, while trade sanctions are more detrimental to the Foreign country**.

The paper also explores the role of a neutral third country that can choose whether to participate in the sanctions. This third country may act as an intermediary, diverting trade and thereby reducing the welfare losses for the Foreign country. Additionally, the third country benefits by absorbing demand from both the sanctioning and sanctioned countries, which can no longer trade directly. This underscores the importance of international coordination in implementing effective sanctions and highlights the challenges posed by third-party interference. In conclusion, the paper provides a detailed analysis of the economic impact of sanctions, with specific estimates for the recent sanctions against Russia. It also compares the effects of different types of sanctions and emphasizes the role of neutral countries in mitigating the intended impact.

The Price of War

Gernot Müller (Univ. of Tubingen), Jonathan Federle (Kiel Institute), André Meier (Tudor Capital Europe LLP), Willi Mutschler (Univ. of Tubingen) and Moritz Schularick (Kiel Institute)

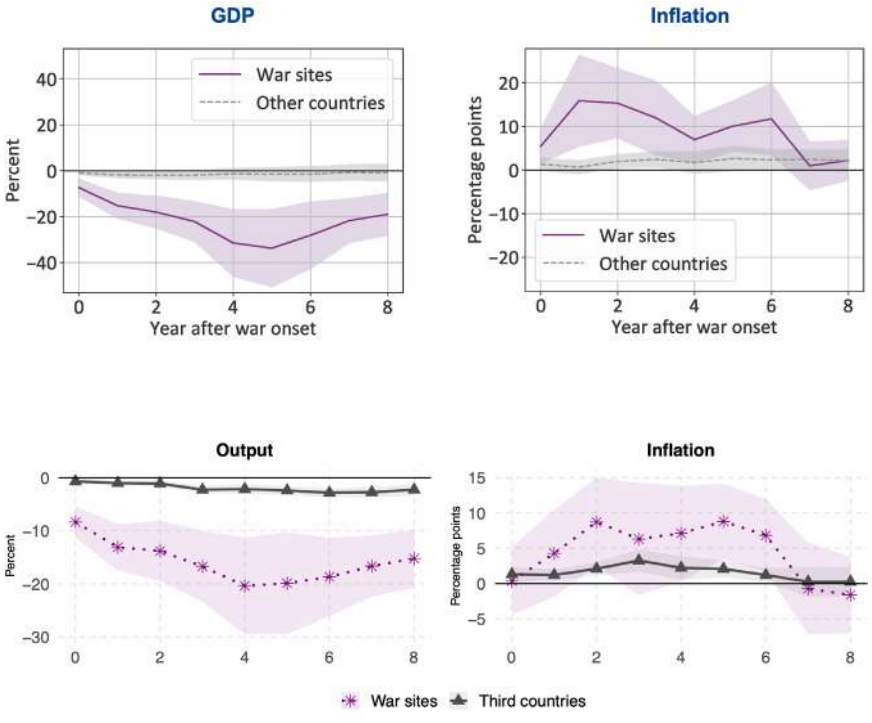
The Price of War, Working Paper, February 2024.

Wars are economic catastrophes, resulting in loss of life and capital destruction. In an increasingly interconnected world, the economic repercussions of wars often extend beyond the conflict zones. Exposure to war is not uncommon in recent history, occurring at a frequency comparable to that of business cycles. Nevertheless, war remains an understudied shock to the global economy. Who ultimately bears the cost of war? Does distance from the conflict site mitigate its economic impact? And can we quantify the economic costs of war? In this paper, the authors construct a new dataset on major wars since 1870, estimate their average impact on GDP and inflation both within and outside the war zones, and quantify the primary transmission channels using a business-cycle model.

The first contribution of the paper is to build a new dataset with interstate wars since 1870, geolocating each conflict. Wars are defined as sustained conflicts with a minimum of 1,000 battle-related fatalities. The dataset identifies 1,625 battles between 1870 and 2024, aggregated to create 224 country-year observations, with an average conflict duration of 2.5 years and an average death toll of 220,000. While the probability of war on domestic soil is low, at 2.4% annually, the likelihood of war in an adjacent country is not, with a 11.4% frequency: this is twice the probability of a financial crisis. Using this dataset, the authors estimate the impact of war on GDP and inflation for the conflict zone and other countries. They find that **the adverse effect of war in the war site gets stronger over time, with output dropping by 20% after 4 years and inflation rising by 10% per year**. Recovery is slow, with output still 15% below pre-war levels after eight years and not fully restored even after 16 years. For neighboring countries, the economic impact diminishes with distance: adjacent countries experience a 5% output loss and an 8% inflation increase after four years, while costs for distant countries are low, and can even turn positive for belligerent countries far from the war site due to output gains from increased military spending.

The paper then presents a business-cycle model of the global economy to identify the transmission channels through which war affects economic output and inflation. The model includes four regions: the War Site, two third countries (Nearby and Distant), and the Rest of the World. These regions differ in size, trade integration (as a proxy for distance), and their exposure to the war shock. The "war shock" directly affects the War Site by (i) destroying part of the capital stock, (ii) reducing total factor productivity, and (iii) triggering an increase in military expenditure. The model is calibrated to match the empirical responses of GDP and inflation in the War Site, with spillover effects on other countries arising endogenously. **As trade with war-site country collapses, it generates an endogenous supply-side contraction abroad, reducing output by 3% for nearby countries, and 1% for distant countries.** Inflation is primarily driven by monetary accommodation, as monetary policy potentially engages in "war financing" through increased money supply. In an extended model version that includes belligerent countries, distant economies may experience output expansion due to military spending increases, provided they are far from the conflict zone.

In conclusion, this paper provides a detailed empirical and quantitative analysis of the economic impact of war, both within and beyond the conflict site. The authors show that the economic cost of war is substantial, with a one-third reduction in GDP and a surge in inflation in the war-affected country, and that war acts as a negative supply shock for nearby countries.



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