Long-Run Consequences of Sanctions on Russia

David Baqaee UCLA

Hannes Malmberg* Minnesota

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After the 2022 invasion of Ukraine, Western countries and their allies imposed severe trade sanctions on Russia. Trade volumes between Russia and major Western economies collapsed, with U.S. and EU goods trade with Russia falling by nearly 90 percent between 2021 and 2023.[1] There have been intense discussions about the economic consequences, ranging over issues such as short-term substitutabilities, nominal frictions, and leakages (e.g. Bachmann et al., 2024; Flach et al., 2024; Itskhoki and Ribakova, 2024).

As Russia's invasion enters its fourth year, understanding longer-term effects become increasingly important. In this paper, we analyze the effect of sustained sanctions when capital stocks are allowed to adjust, using a new framework for balanced growth path analysis developed by Baqaee and Malmberg (2025). They characterize balanced growth comparative statics for a large class of models, and apply their findings to a specific calibrated trade model. In this paper, we analyze sanctions using that model.

We find that when capital is allowed to adjust, long-run consumption declines are larger: 1.4 times larger for Russia and 2.2 times larger for Eastern Europe. Thus, capital adjustment works against the intuition that long-run effects are milder than short-run

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[1]See https://www.census.gov/foreign-trade/balance/c4621.html#2024 and https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_trade_with_Russia_-_latest_developments.

effects due to greater adjustment opportunities. The reason is that for capital, adjustment opportunities amplify, rather than dampen, the initial effects.

The model we use inherits its basic structure from standard static quantitative trade models. There are N industries, and production by each industry i in country o combines labor, L_{oi}, capital, K_{oi}, and intermediate inputs, $Y_{oi,j}$, using a Cobb-Douglas technology:

$$Y_{oi} = L_{oi}^{\tilde{\Omega}_{oi,L}} K_{oi}^{\tilde{\Omega}_{oi,K}} \prod_{j=1}^{N} Y_{oi,j}^{\tilde{\Omega}_{oi,j}}.$$

Inputs from industry j used by industry i in country o are CES bundles of varieties from different origin countries:

$$Y_{oi,j} = \left(\sum_{o'} \omega_{oi,o'j} \left(\tau_{oi,o'j} Y_{oi,o'j} \right)^{\frac{\theta}{\theta+1}} \right)^{\frac{\theta+1}{\theta}},$$

where $\tau_{oi,o'j}$ captures iceberg trade costs and θ is the trade elasticity.

Every industry i in country o has its own capital stock that evolves according to

$$\dot{K}_{oi} = X_{oi} - \delta_i K_{oi},$$

where δ_i is the depreciation rate in industry i and X_{oi} is the investment good. Investment is produced using inputs from different industries combined using a Cobb-Douglas aggregator over CES nests, analogous to the production of other goods.

Returns to capital, net foreign asset positions, and trade deficits are endogenous, and depend on households' accumulation decisions. The household sector features a perpetual-youth overlapping generation structure as in Blanchard (1985). Financial markets are incomplete: households can invest in an internationally traded riskless bond or in industry-specific local capital, where they face non-diversifiable idiosyncratic investment risk, similar to Angeletos and Panousi (2011). Heterogeneous returns across capital goods arise from differences in the degree of non-diversifiable risk. The model delivers closed-form

solutions for asset demand. Physical capital markets clear through endogenous risk premia and the global bond market clears through the risk-free rate.

Table 1: Region definitions

Region	**Countries in region**
United States	United States
Western Countries	Australia, Austria, Belgium, Canada, Cyprus, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Sweden
Eastern Europe	Poland, Hungary, Slovenia, Slovakia, Romania, Czech Republic, Bulgaria, Estonia, Latvia, Lithuania
East Asia ex. China	Japan, South Korea, Taiwan
China	China
Russia	Russia
Rest of the World	Rest of the World

We model the world economy using seven aggregated regions, as shown in Table 1. We implement sanctions as prohibitive export and import iceberg costs between Russia and Western-aligned regions (USA, Western Countries, Eastern Europe, and East Asia excluding China). We are interested in the effects of sanctions on the level of the balanced growth paths as illustrated in Figure 1.

We follow the same calibration strategy as in Baqaee and Malmberg (2025). The calibration and solution strategy exploits a key result in their paper, which is that long-run analyses can be conducted using an as-if static economy where capital is an intermediate input subject to endogenous markups. The as-if markups reflect deviations from the Golden Rule, and are larger for capital goods with high returns relative to their depreciation rates. On the balanced growth path, the as-if markup on each capital good equals the ratio of capital income to investment in its corresponding industry.

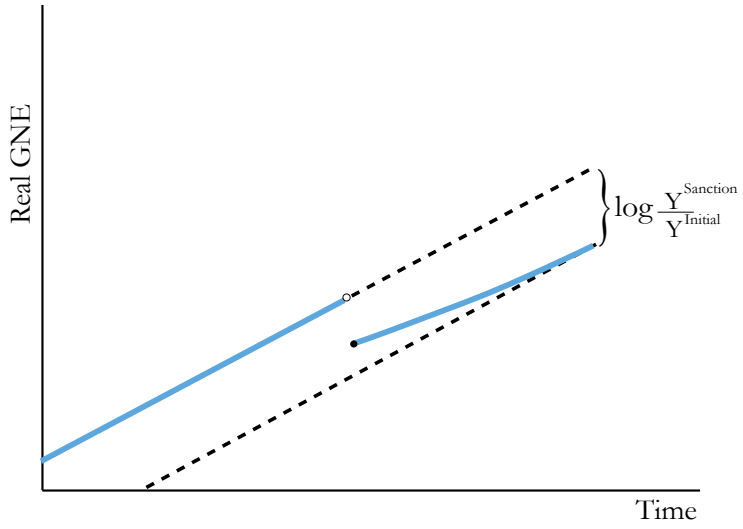

Figure 1: Illustration of response of GNE to sanctions.

Calibration relies on the World Input-Output Database (Timmer et al., 2015), the External Wealth of Nations Database (Lane and Milesi-Ferretti, 2018), investment flow tables constructed by Ding (2022), and the integrated industry-level production accounts from the Bureau of Economic Analysis. Each region block has 26 industries covering primary, manufacturing, and service industries.

Table 2 reports a few statistics for a selection of countries. According to the World Input-Output Database, capital income's share of GDP hovers around 40%, whereas the investment rate is around 20% of GDP. This implies that the average as-if markup on capital services is around two. The implied return on physical capital, net of depreciation, is around 10% but varies across countries. Imports relative to GDP vary widely and are smaller for large regions. The United States, Western countries, and Eastern Europe all have negative net foreign asset positions, whereas Russia's is slightly positive.

Table 3 reports the effects of sanctions that shut down trade between Russia and Western allies for different values of the trade elasticity θ.[2] The first two columns show changes in long-run consumption and gross national expenditures (GNE) for selected regions.

[2]We calculate the non-linear effects of sanctions by chaining first-order effects, which are obtained using a hat-algebra style solution.

Table 2: Selected calibrated values for a subset of countries

	USA	W. Countries	E. Europe	RUS
Average return to capital	0.106	0.138	0.112	0.134
Average as-if markup	2.373	2.480	2.178	2.632
Investment rate	0.177	0.165	0.229	0.180
Capital income	0.420	0.409	0.498	0.474
Import share	0.121	0.148	0.408	0.213
Net foreign assets	-0.188	-0.140	-0.436	0.021

Note: Data averaged over 1995-2009. Capital returns are weighted by the capital stock. As-if markups are income-weighted harmonic averages.

Real GNE, sometimes called domestic absorption, is the sum of real consumption, government spending, and investment.[3] The last column reports the change in the capital stock of each region.[4]

Across all values of θ, the losses are largest for Russia and Eastern Europe, and milder for the United States and other Western countries. For the regions involved in the dispute, consumption and GNE decline. Neutral regions like China and the rest of the world experience small gains. Real consumption and GNE move roughly in line with one another for each region, reflecting the fact that the shock does not dramatically move either the ratio of nominal investment to consumption, nor the relative price of consumption to investment goods. The shock also tends to reduce the capital stock in the directly affected regions, since the disruption in trade raises the price of investment goods relative to labor.

Losses in long-run consumption are declining in the trade elasticity, in line with intuitions from static trade models. For a standard value of θ equal to 4 (see, e.g., Broda and Weinstein, 2006; Simonovska and Waugh, 2014), Russian long-run consumption falls by around 8.5%, Eastern European consumption falls by around 2%, Western countries'

[3]Whereas GDP measures real production for each region, GNE measures real spending for each region, regardless of where the goods and services were produced (for more information see, e.g., Baqaee and Farhi, 2024).

[4]We measure the decline in the capital stock via a Laspeyres index of capital services, i.e., the average change in capital services weighted using initial capital compensation shares. We do not report changes in financial variables like net foreign asset positions, the current account, and rates of return in our experiment since they do not respond strongly to the shock given our specification of asset supply and demand.

consumption falls by around 0.3%, and US consumption is almost unaffected.

Table 3: Long-run responses to sanctions for selected regions

Country	Trade elasticity	Consumption	GNE	Capital
USA	$\theta = 1$	-0.18%	-0.19%	-0.25%
	$\theta = 4$	-0.03%	-0.03%	-0.02%
	$\theta = 7$	-0.01%	-0.01%	0.01%
Western Countries	$\theta = 1$	-1.05%	-1.06%	-1.12%
	$\theta = 4$	-0.26%	-0.25%	-0.21%
	$\theta = 7$	-0.14%	-0.12%	-0.07%
Eastern Europe	$\theta = 1$	-6.62%	-6.68%	-6.84%
	$\theta = 4$	-2.01%	-2.05%	-2.13%
	$\theta = 7$	-1.17%	-1.21%	-1.27%
Russia	$\theta = 1$	-28.2%	-28.9%	-31.5%
	$\theta = 4$	-8.48%	-9.13%	-10.4%
	$\theta = 7$	-4.83%	-5.45%	-6.38%
China	$\theta = 1$	-0.04%	-0.00%	0.03%
	$\theta = 4$	0.02%	0.07%	0.14%
	$\theta = 7$	0.02%	0.07%	0.13%

For comparison, Table 4 conducts the same experiment in a static version of the model where capital is treated as an endowment, and investment is treated as a final expenditure.[5] This is the approach taken in most static trade models, e.g. Costinot and Rodriguez-Clare (2014).[6] When capital is not allowed to adjust, consumption losses are roughly half as large as those in Table 3.

Another difference between the model with fixed and variable capital, not shown in the tables, is the incidence of shocks. For example, when the capital stock is fixed, sanctions cause Russian average real rental prices to fall by 4.7% and average real wages by 4.8%. As capital is decumulated, the average real rental price recovers, eventually rising by

[5]Formally, we assume that there is a single investment/consumption good aggregate.

[6]For trade models featuring capital accumulation, see, e.g., Alvarez (2017), Alessandria et al. (2021), Ding (2022), Dix-Carneiro et al. (2023).

1.5% compared to its pre-shock level. In contrast, the average real wage falls even further, eventually falling by 9.1% below its pre-shock level.

In conclusion, we find that it is important to account for capital adjustment when considering long-run effects of sanctions. Capital moves signficantly in the long-run, leading to considerably larger responses in long-run consumption, especially in Eastern Europe. This short paper focuses on sanctions and use purely numerical methods. However, the mechanisms we emphasize are important for a wide range of counterfactuals in both open and closed economies. For an analytical and numerical analysis of these broader issues, see Baqaee and Malmberg (2025).

Table 4: Long-run responses to sanctions for selected regions in static version of the model

Country	Trade elasticity	Consumption	GNE	Capital
USA	$\theta = 1$	-0.08%	-0.08%	0.00%
	$\theta = 4$	-0.02%	-0.02%	0.00%
	$\theta = 7$	-0.01%	-0.01%	0.00%
Western Countries	$\theta = 1$	-0.53%	-0.53%	0.00%
	$\theta = 4$	-0.14%	-0.14%	0.00%
	$\theta = 7$	-0.08%	-0.08%	0.00%
Eastern Europe	$\theta = 1$	-3.32%	-3.32%	0.00%
	$\theta = 4$	-0.91%	-0.91%	0.00%
	$\theta = 7$	-0.52%	-0.52%	0.00%
Russia	$\theta = 1$	-22.4%	-22.4%	0.00%
	$\theta = 4$	-6.54%	-6.54%	0.00%
	$\theta = 7$	-3.72%	-3.72%	0.00%
China	$\theta = 1$	0.10%	0.10%	0.00%
	$\theta = 4$	0.04%	0.04%	0.00%
	$\theta = 7$	0.03%	0.03%	0.00%

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