Financial Sanctions Interact(ed) with Trade Sanctions*

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Abstract

Trade and financial sanctions have played and continue to play a prominent role in geopolitics. Empirically, we show that there is a strong nonlinearity in their interaction. While both types of sanctions can significantly harm the sanctioned country in terms of GDP losses, their combined effect ultimately depends on the order in which they are implemented. When financial sanctions precede trade sanctions, they amplify the effect of the latter, but not vice versa. We theoretically argue that this finding is related to the fact that financial sanctions weaken the financial sector of the sanctioned country and, thus, also amplify all other shocks, while trade sanctions are mainly an impulse. As a result, if a trade sanction is imposed after a financial sanction, the aggregate business cycle effects are exacerbated, but if a trade sanction precedes a financial sanction, the latter's effects remain unchanged.

Keywords: financial sanctions, trade sanctions, open economy, sanction effectiveness, financial accelerator

JEL codes: E44, F10, F34, F38, F41, F51

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1 Introduction

A weak financial system can make an economy more vulnerable to adverse economic shocks. In this paper, we show that this basic insight can be exploited in the design of economic sanctions. Economic sanctions have become an important tool of geopolitics, where one country tries to inflict damage on another country in order to pressure the sanctioned country to behave in a desired way. Typically, trade is at the center of the sanctions debate, but the use of financial sanctions has become increasingly common in recent decades. The extent to which this practice has meaningful economic consequences is an understudied topic. We show that by making a country more vulnerable to demand shocks, financial sanctions implemented ahead of trade sanctions cause significant additional damage to the sanctioned country in terms of GDP losses. In contrast, when financial sanctions follow trade sanctions, they are virtually inconsequential.

As economic sanctions are increasingly multidimensional, trade and financial sanctions—besides others, such as travel sanctions—are often imposed in tandem (Felbermayr et al., 2020). This has been the case in the international response to the Russo-Ukrainian War, but was practiced already well before, resulting in a sequence of sanctions. This is well reflected, for instance, by the comprehensive and long-lasting sanctions on Cuba imposed by the United States. While trade sanctions against Cuba were introduced in 1960, financial (and other) sanctions were introduced one year later. The trade dimension was boosted significantly by the Helms-Burton Act in 1996, effectively forcing international firms to choose between the Cuban and the U.S. market, but additional financial sanctions followed and Cuba's financial isolation has been further reinforced by banks' endogenous response to them. The logic of economic sanctions is simple: a trade sanction removes demand for exported goods and renders production less efficient by making imported varieties unavailable. A weakened financial sector can have detrimental effects on investment within the country and hinders international risk sharing.

We use comprehensive data on trade and financial sanctions around the world to shed light on the effectiveness of financial sanctions, trade sanctions, and their interaction. By accounting for the order in which they are implemented, we show that an important aspect of financial sanctions is that they increase the effectiveness of subsequent trade sanctions. On an intuitive basis, consider the case of financial sanctions against Russia following its full-scale invasion of Ukraine in 2022. As a result of the financial sanctions, Russian banks lost access to correspondent banking services, which can in turn affect the export activity of corporate borrowers (Borchert et al., 2024).

We find that this amplifying effect of financial sanctions is empirically robust. It holds when accounting for different time lags between the two types of sanctions and also when controlling for time-varying unobserved heterogeneity at the continental level. However, such panel evidence relies on the identifying assumption that the order of sanctions is plausibly exogenous, and that, at least for the impact when both types of sanctions are active, any pre-period effects stemming from the sanction implemented first are similar regardless of the order of financial and trade sanctions.

To scrutinize further the characteristics of the two different sequences—financial before trade vs. trade before financial sanctions— we zoom in on such episodes and consider, in particular, the different timing of the second type of sanction and the evolution of the share of the world economy imposing these sanctions over time. A striking difference is that when both financial and trade sanctions are in place eventually, the latter are imposed alone for a longer time than the former are. To rule out that such differences drive our results, we move our analysis to the sanction episode by country level, which enables us to control for a host of characteristics of the way how financial and trade sanctions are implemented (before they are implemented jointly eventually). Even after controlling for the number of years the first sanction has been in place before the second sanction is implemented, and also for the composition of countries imposing both sanctions, we find that episodes with financial sanctions preceding trade sanctions are more effective than episodes with the reverse order.

We then show that a two-country New Keynesian model with a financial sector in the spirit of Gertler and Karadi (2011) predicts exactly this: financial sanctions amplify the effect of trade sanctions, but not vice versa. We model a trade sanction as an unexpected increase in trade costs and a financial sanction as the destruction of some of the net worth of the sanctioned country's banking sector. While arguably at a high level of abstraction, both capture the essence of trade and financial sanctions. The goal of trade sanctions is to impede the sanctioned country's exports and imports. In practice, sanctions can be circumvented by trading through third-party hubs, which is captured by our increase in trade costs. Similarly, financial sanctions consist of a wide range of concrete measures, such as asset freezes or exclusion from international payment systems. What they all have in common is that they make it more difficult for the banking sector of the sanctioned country to operate normally and to channel funds to the most efficient investment uses. In a Gertler and Karadi style model, this is well captured by a decline in the banking sector's net worth, or a change in the parameters governing the agency problems in the financial sector. The advantage of the net-worth formulation is that it takes into account the incentives to reverse the financial sanctions in the sanctioned country.

The effect of strong financial sanctions is to move the banking sector of the sanctioned country from a regime in which the sector is unconstrained in channelling funds to investment to a regime in which investment in the sanctioned country is constrained by the capacity of the financial sector. The important effect of the financial sanction is then not so much its direct effect on economic activity, but that the sanctioned economy is less capable of absorbing shocks such as a trade sanction when it has an impaired financial sector. Because it takes time to rebuild the financial sector, this destabilizing effect is long-lasting. The reverse is not true. In our model, trade sanctions have a much stronger short-run than long-run effect. Thus, by the time a trade shock is followed by a financial sanction, the former will have largely dissipated and cannot be reinforced much. Having said that, we also find that a trade shock puts additional stress on the financial sector by further reducing net worth, but this effect is negligible and cannot trigger a nonlinearity.

Related literature. Our paper contributes to several strands of the sanctions literature. First, we complement the empirical literature on financial sanctions, which has analyzed the effect of financial sanctions on financial flows between target and sender countries. Besedeš, Goldbach and Nitsch (2017) show that financial sanctions are indeed associated with a decline in financial flows, but that they are also circumvented when only parts of the global economy impose such sanctions, which in turn leads to financial flows between the sender and the target being replaced by new flows between the target and non-sanctioning third countries. Besedeš, Goldbach and Nitsch (2018) extend this analysis by considering the effects on the sender country, and show that firms in the sender country also substitute their activities towards non-sanctioning third countries. They conclude that the economic cost of financial sanctions to the sender is limited, which is also consistent with the findings in Efing, Goldbach and Nitsch (2023) for German bank lending in countries targeted by financial sanctions. We add to this literature by providing empirical evidence that financial sanctions also affect real variables, in particular GDP, highlighting their relevance not only for the financial but also for the non-financial sector. Most importantly, we focus on the interaction between financial and trade sanctions, especially with respect to their timing. Our macroeconomic model then provides a causal interpretation of these results.

In economics, there has been a significant increase in the number of papers studying sanctions at the onset of the Russian occupation of Crimea in 2014 and the expansion of the Russian war of aggression to all of Ukraine in 2022. Keerati (2023) finds that U.S. financial sanctions on Russian firms after the 2014 annexation of Crimea unintentionally strengthened targeted firms by reallocating domestic resources in their favor, causing them to contract less than unsanctioned firms. Mamonov and Pestova (2022) analyze the economic impact of international sanctions on Russia from 2014 to 2022, and finds that richer households and large firms were affected the most, with declining incomes and revenues, while poorer households experienced a slight increase in income. Mamonov, Pestova and Ongena (2021) find that financial sanctions on Russian banks from 2014 to 2019 led targeted banks to reduce foreign assets, but also increased international borrowing. Government support mitigated economic losses by offsetting lower corporate lending with higher household lending. By considering the full panel of sanction cases from 1949 to 2020 around the globe, we can provide a more general intuition about the aggregate effect of sanctions.

Finally, we contribute to the theoretical understanding of the macroeconomic channels of sanctions. Recent models of trade sanctions include Lorenzoni and Werning (2023) and Itskhoki and Mukhin (2022). In particular, Itskhoki and Mukhin (2022) use an open-economy model to rationalize the behavior of the exchange rate in response to a similar set of sanctions, and calibrate a linearized version of their model to the case of sanctions against Russia in 2022. Bianchi and Sosa-Padilla (2024) study financial sanctions, in particular through international reserves. Most closely related to our model, Itskhoki and Mukhin (2023) provide a highly stylized framework in which they study the importance of the sequencing of trade sanctions for possible deviations from the Lerner symmetry of export and import tariffs. Our contribution to this literature is to apply sanction shocks to a fully nonlinear dynamic general equilibrium model of the economy, focusing on the effects on welfare-relevant variables. In particular, our approach allows for the study of interaction effects of sanctions, which have been neglected in the literature.

2 The Economic Costs of Financial and Trade Sanctions

In this section, we provide a first empirical prior for the importance of financial sanctions and how they interact with trade sanctions. Our empirical analysis builds on a comprehensive collection of sanctions worldwide, based on Felbermayr et al. (2020), which we augment to a long country-year panel for sanctioned countries. We show empirically that both financial and trade sanctions alone as well as their interaction have a negative effect on GDP in the target economy. Importantly, the interaction effect has a heterogeneous component in that it is significant only if financial sanctions are already in place ahead of any trade sanctions.

2.1 Institutional Setting and Data

The Global Sanctions Database (GSDB, Felbermayr et al., 2020; Kirilakha et al., 2021) contains sanction episodes with a particular focus on the 20$^{\text{th}}$ and 21$^{\text{st}}$ century. The data indicate the target and sanctioning countries, as well as sanction types. We augment this dataset with additional sanctions, thereby yielding the most comprehensive sanctions database to date with a grand total of 1,340 sanctions. We combine these data with country-level aggregate variables, such as GDP, from FRED. This yields a dataset that allows us to study sanction effects at the country by year level. Our final sample period is 1949 to 2020.

That is, the level of observation is a (target) country-year pair. For each sanctioned country c in a given year t, we compute variables capturing the sender-GDP weighted sum of active financial and trade sanctions. We present all relevant summary statistics

Table 1: Summary Statistics

Variable	Mean	Std. dev.	Min	Max	N
Financial sanctions (GDP weighted)	0.208	0.256	0	1	3,674
Any financial sanctions (indicator)	0.627	0.484	0	1	3,674
Trade sanctions (GDP weighted)	0.102	0.207	0	1	3,674
Any trade sanctions (indicator)	0.535	0.499	0	1	3,674
Financial before trade sanctions (1 year)	0.096	0.294	0	1	3,674
Financial before trade sanctions (2 years)	0.077	0.267	0	1	3,674
Trade before financial sanctions (1 year)	0.065	0.246	0	1	3,674
Trade before financial sanctions (2 years)	0.029	0.167	0	1	3,674

Notes: $\textit{Financial sanctions}_{c,t}$ and $\textit{Any financial sanctions}_{c,t}$ denote, respectively, a continuous measure of financial sanctions imposed on country c in year t weighted by GDP of the sanctioning country and an indicator variable for any financial sanctions imposed on country c in year t. $\textit{Trade sanctions}_{c,t}$ and $\textit{Any trade sanctions}_{c,t}$ are defined analogously for trade sanctions. $\textit{Financial before trade sanctions}_{c,t}$ is an indicator variable for whether any financial sanctions were implemented $X \in \{1,2\}$ years before any trade sanctions were, conditional on both financial and trade sanctions being in place in country c and year t. $\textit{Trade before financial sanctions}_{c,t}$ is defined analogously.

in Table 1. Besides $\textit{Financial sanctions}_{c,t}$ and $\textit{Trade sanctions}_{c,t}$, we also show summary statistics for simple dummy versions reflecting whether a country is on the receiving end of *any* financial or trade sanctions. Furthermore, we use information on the sequencing of financial and trade sanctions, conditional on both being in place, to generate $\textit{Financial before trade sanctions}_{c,t}$, which is an indicator variable for whether any financial sanctions were implemented $X \in \{1,2\}$ years before any trade sanctions were, and $\textit{Trade before financial sanctions}_{c,t}$ defined analogously.

Financial sanctions are more likely to be imposed than trade sanctions are. In terms of sequencing, conditional on both trade and financial sanctions being in place, it is more often the case that financial sanctions precede trade sanctions than the other way around.

2.2 Panel Evidence

We next use our panel data to shed light on the economic costs of financial and trade sanctions for sanctioned countries. As a baseline, we estimate the following specification:

$$\begin{aligned} \ln(GDP)_{c,t} &= \beta_1 \textit{Financial sanctions}_{c,t-1} + \beta_2 \textit{Trade sanctions}_{c,t-1} \\ &\quad + \mu_c + \theta_{o(c)t} + \epsilon_{ct}, \end{aligned} \tag{1}$$

where $GDP_{c,t}$ measures country c's GDP in year t, $\textit{Financial sanctions}_{c,t-1}$ is a continuous measure of financial sanctions imposed on country c in year $t-1$ weighted by GDP of the

Table 2: Baseline Effects of Financial and Trade Sanctions on GDP

	$\ln(GDP_{c,t})$			
Sample	All countries	Financially developed		
	(1)	(2)	(3)	(4)
Financial sanctions	-0.295**	-0.269*	-0.292*	-0.238**
	(0.137)	(0.163)	(0.155)	(0.114)
Trade sanctions	-0.255	-0.328	-0.395**	-0.310
	(0.201)	(0.213)	(0.189)	(0.205)
Financial sanctions × Trade sanctions				-0.180
				(0.376)
Country FE	Y	Y	Y	Y
Year FE	Y	Y	N	N
Continent-Year FE	N	N	Y	Y
N	2,757	2,530	2,455	2,455

Notes: The level of observation is a country-year ct. The first column includes all countries, whereas the last three columns include only countries with an average ratio of bank deposits to GDP in excess of 10%. The dependent variable is the natural logarithm of country c's GDP in year t. $\textit{Financial sanctions}_{c,t-1}$ is constructed as the GDP-weighted fraction of countries imposing financial sanctions on country c in the year $t-1$. $\textit{Trade sanctions}_{c,t-1}$ is the analogously constructed weighted average for trade sanctions. Robust standard errors (double-clustered at the country and year levels) are in parentheses.

sanctioning country, and $\textit{Trade sanctions}_{c,t-1}$ is defined analogously for trade sanctions. μ_c and $\theta_{o(c)t}$ denote, respectively, country and country c's continent by year fixed effects. We double-cluster standard errors at the country and year levels.

The results are in Table 2. In the first column, with simple year instead of continent by year fixed effects, we estimate quantitatively similar coefficients for both types of sanctions in the sample of all countries, although only the coefficient for financial sanctions is statistically significant, while that for trade sanctions is noisily estimated. To account for the fact that financial sanctions are most likely ineffective in countries without a functioning financial sector, we re-estimate the same specification as in the first column for countries with an average deposits to GDP ratio in excess of 10%, which omits not even one-tenth of our sample, and yield similar results (column 2). A notable difference is that while the coefficient for financial sanctions remains statistically significant, that on trade sanctions increases in (absolute) size but remains statistically insignificant.

Henceforth, we focus on said subset of countries and augment our specification with the full set of granular fixed effects as in (1). By including continent by year fixed effects, we account for time-varying unobserved heterogeneity across continents that could potentially explain GDP differences. After controlling for such variation in column 3, both coefficients increase further in (absolute) size and are statistically significant. The fact that the effect of trade sanctions may only be noisily estimated leads us to explore a potential interaction effect between the two types of sanctions. To this end, in column 4, we also include an interaction term for financial and trade sanctions, which is negative but far from statistically significant.

Taking stock, we find a strong and statistically significant effect of financial sanctions, with a one-standard-deviation increase in $\textit{Financial sanctions}_{c,t-1}$ amounting to $(0.292 \times 0.242$ (in the respective sample) $=)$ 7.1% lower GDP in non-western countries (column 3). While of similar magnitude, the effect of trade sanctions is noisily estimated, and so is their interaction with financial sanctions. While the latter also carries a negative sign, the fact that it is statistically insignificant may mask underlying heterogeneity that we will turn to next.

In particular, we consider the possibility that the timing of financial and trade sanctions matters for the interaction effect. To account for it, we augment our specification with interactions with the two indicator variables reflecting the sequence of sanctions, $\textit{Financial before trade sanctions}_{c,t-1}$ and $\textit{Trade before financial sanctions}_{c,t-1}$. As the respective effects can be estimated only if both $\textit{Financial sanctions}_{c,t-1}$ and $\textit{Trade sanctions}_{c,t-1}$ are non-zero, we estimate for both variables an interaction term with $\textit{Financial sanctions}_{c,t-1}$ and $\textit{Trade sanctions}_{c,t-1}$:

$$\begin{aligned}
\ln(GDP)_{c,t} \quad = \quad & \beta_1 \textit{Financial sanctions}_{c,t-1} \times \textit{Trade sanctions}_{c,t-1} \\
& \times \textit{Financial before trade sanctions}_{c,t-1} \\
& + \beta_2 \textit{Financial sanctions}_{c,t-1} \times \textit{Trade sanctions}_{c,t-1} \\
& \times \textit{Trade before financial sanctions}_{c,t-1} \\
& + \beta_3 \textit{Financial sanctions}_{c,t-1} \times \textit{Trade sanctions}_{c,t-1} \\
& + \beta_4 \textit{Financial sanctions}_{c,t-1} + \beta_5 \textit{Trade sanctions}_{c,t-1} + \mu_c + \theta_{o(c)t} + \epsilon_{ct},
\end{aligned} \tag{2}$$

As such, β_3 captures the effect of simultaneous financial and trade sanctions, whereas β_1 (β_2) reflects whether there is a differential effect when financial and trade sanctions are currently in place, but financial (trade) sanctions were already in place one ($X = 1$) or two ($X = 2$) years before any trade (financial) sanctions were implemented.

The results for $X = 1$ are in column 1 of Table 3, and indicate that there is no additional (negative) effect of combining financial and trade sanctions (β_3 is positive, but outweighed by the stand-alone effects, and insignificant). However, implementing financial sanctions ahead of trade sanctions has a statistically significant additional (negative) effect on GDP, and is also significantly more effective than the reverse sequence (the difference between β_1 and β_2 is significant at the 9% level). This remains true also after controlling for an additional lag of the stand-alone sanction variables, i.e., $\textit{Financial sanctions}_{c,t-2}$ and $\textit{Trade sanctions}_{c,t-2}$, in column 2. Doing so addresses the potential concern that in the first year that financial and trade sanctions are both in place, any additional effect from different sequencing could stem from the mechanical

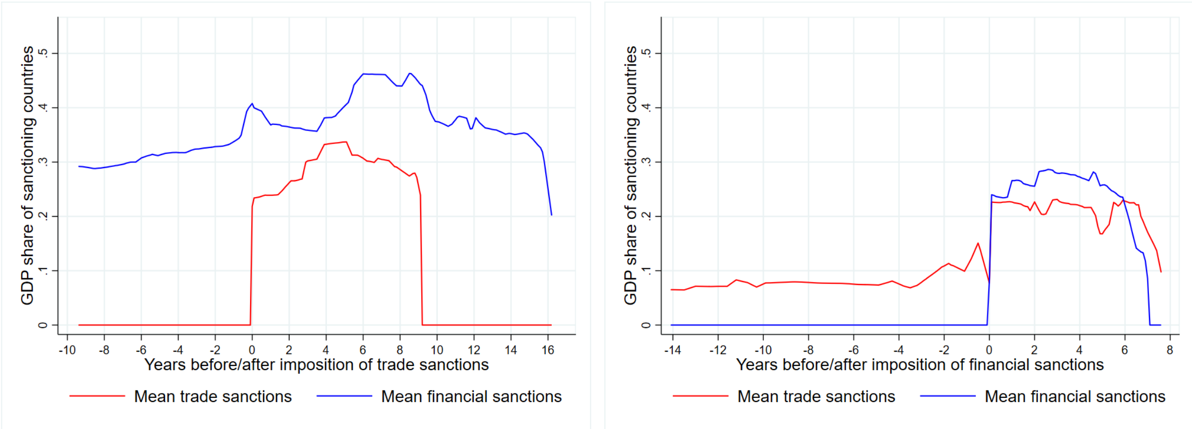
Table 3: Asymmetric Effects of Combined Sanctions

	$\ln(GDP_{c,t})$		
'before' cutoff	1 year	1 year	2 years
	(1)	(2)	(3)
Financial sanctions × Trade sanctions	-0.888*	-0.947**	-1.025**
× Financial *before* trade sanctions	(0.461)	(0.455)	(0.458)
Financial sanctions × Trade sanctions	-0.002	-0.037	-0.154
× Trade *before* financial sanctions	(0.195)	(0.193)	(0.167)
Financial sanctions × Trade sanctions	0.305	0.392*	0.485*
	(0.210)	(0.232)	(0.271)
Financial sanctions (1 year before)	-0.265*	-0.208	-0.216
	(0.134)	(0.169)	(0.192)
Financial sanctions (2 years before)		-0.093	-0.063
		(0.112)	(0.109)
Financial sanctions (3 years before)			-0.041
			(0.130)
Trade sanctions (1 year before)	-0.282	-0.232	-0.245
	(0.190)	(0.154)	(0.169)
Trade sanctions (2 years before)		-0.091	-0.045
		(0.150)	(0.111)
Trade sanctions (3 years before)			-0.074
			(0.130)
Country FE	Y	Y	Y
Continent-Year FE	Y	Y	Y
N	2,455	2,249	2,068

Notes: The level of observation is a country-year ct. The sample is limited to countries with an average ratio of bank deposits to GDP in excess of 10%. The dependent variable is the natural logarithm of country c's GDP in year t. *Financial sanctions*$_{c,t-1}$ is constructed as the GDP-weighted fraction of countries imposing financial sanctions on country c in the year $t-1$. *Trade sanctions*$_{c,t-1}$ is the analogously constructed weighted average for trade sanctions. *Financial before trade sanctions*$_{c,t-1}$ is an indicator variable for whether any financial sanctions were implemented one year (in columns 1 and 2) or two years (column 3) before any trade sanctions were, conditional on both financial and trade sanctions being in place in country c and year $t-1$. *Trade before financial sanctions*$_{c,t-1}$ is defined analogously. Robust standard errors (double-clustered at the country and year levels) are in parentheses.

Figure 1: Event Study Graphs of the Share of the World Economy Imposing Financial and Trade Sanctions Over Time

(a) Financial before trade sanctions (b) Trade before financial sanctions



fact that the respective sanction has already been in place for at least one year.

Finally, we consider an even larger gap in the sequencing of the two types of sanctions ($X = 2$) in column 3, and add another lag of the respective stand-alone variables. If anything, our main finding becomes even stronger in terms of both statistical and economic significance: there is a significant negative effect on GDP when trade sanctions are preceded by financial sanctions. These conclusions hold true also when lagging all right-hand side variables by another year, so that we capture the effect on GDP after two years instead of one year (Table A.1 in the Appendix).

2.3 Empirical Facts and Motivating Evidence of Sequential Sanctions

The heterogeneous effects uncovered in the previous subsection prompt a deeper inquiry into how financial and trade sanctions unfold differently depending on their order of implementation.[1] For this purpose, we zoom in on sanction episodes where at any point in time financial and trade sanctions coincide. Conditional on the latter, the start of an episode is given by the start year of the first sanction, and the end is given by the last year during which any sanction is still in place.

Figure 1 presents two event study graphs. In particular, we plot the average share of the world economy (measured in GDP) imposing financial and/or trade sanctions on a given country in an episode, and normalize the time scale accordingly. Sequences for which financial sanctions precede trade sanctions differ notably from those where the reverse is the case. While the time during which both financial and trade sanctions are

[1]As such, we do not take into account cases where financial and trade sanctions are imposed simultaneously at first, even if they may stop at different times.

jointly in place is similarly long across the two types of sequences, the remaining time when only one of the two sanctions is active is split up differently. Trade sanctions are imposed alone for a longer period of time (before financial sanctions kick in) than financial sanctions are (before trade sanctions kick in).

Most importantly, when trade sanctions join financial sanctions, the GDP share of countries imposing financial sanctions does not increase markedly (Panel A). In contrast, when financial sanctions join trade sanctions, the GDP share of countries imposing either sanction jumps up and moves in tandem thereafter (Panel B). As a result, the GDP share imposing trade sanctions (at time 0) after financial sanctions are already in place that have also imposed financial sanctions in the year before is 80%—much higher than the reverse, i.e., the GDP share imposing financial sanctions after trade sanctions are already in place that have also imposed trade sanctions in the year before (64%). Similarly, the GDP share imposing financial sanctions (at time 0) that already did so before is also higher than the respective GDP share of countries imposing trade sanctions (78% vs. 56%).

While we control for pre-period differences before both financial and trade sanctions coincide in (3) by including lagged sanction variables on the right-hand side, our panel evidence does not account for any other differences stemming from the pre-period, such as the duration of the preceding type of sanction. To do so, we move our regression analysis to the sanction episode by country level, including for each episode not only the sanctioned country itself but also all other countries (as control groups) that did not experience any sanction during the time period under consideration.

Using this stacked regression setup at the episode by country level ec, we estimate the following specification using as dependent variable the difference in the natural logarithm of a given country c's GDP X years after the year t the second type of sanction is implemented vs. its GDP one year before the start of the first sanction:

$$\begin{aligned}\Delta\ln(GDP)_{ec}^{t(e)+X,-1} \quad = \quad & \beta_1 \textit{Financial sanctions}_{c,t(e)} \times \textit{Trade sanctions}_{c,t(e)} \\ & \times \textit{Financial before trade sanctions}_{c,t(e)} \\ & + \beta_2 \textit{Financial sanctions}_{c,t(e)} \times \textit{Trade sanctions}_{c,t(e)} \\ & + \beta_3 \mathbf{X}_{c,t(e)} + \delta_e + \mu_c + \theta_{o(c)t(e)} + \epsilon_{ec}, \end{aligned} \tag{3}$$

where $X \in \{1,2\}$ and $t(e)$ indicates the year the second type of sanction is implemented (i.e., the first year both types of sanctions are jointly in place), which—just like the list of countries—is determined by the characteristics of a given sanction episode e. Furthermore, $\textit{Financial sanctions}_{c,t(e)}$ and $\textit{Trade sanctions}_{c,t(e)}$ are, as before, continuous measures of financial and trade sanctions, respectively, imposed on country c in year t weighted by the GDP of the sanctioning country. By definition, both variables are equal to 0 throughout an episode for all control countries. $\textit{Financial before trade sanctions}_{c,t(e)}$

Table 4: Asymmetric Effects of Combined Sanctions: Episode by Country Level

	$\Delta \ln(GDP)_{ec}^{t(e)+1,-1}$			
Sample				Financially developed
	(1)	(2)	(3)	(4)
Financial sanctions × Trade sanctions	-4.925**	-6.063***	-6.108***	-9.638**
× Financial before trade sanctions	(2.225)	(1.955)	(1.970)	(3.599)
Financial sanctions × Trade sanctions	3.878	4.807**	4.861**	8.289**
	(2.273)	(1.996)	(2.019)	(3.861)
No. of years before second sanction	-0.032**	-0.041***	-0.041***	-0.066***
	(0.012)	(0.009)	(0.009)	(0.022)
GDP share second & first sanction		0.276*	0.749**	2.058***
		(0.153)	(0.363)	(0.514)
GDP share first sanction before & after			-0.490	-2.044***
			(0.472)	(0.604)
Episode FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
Continent-Time FE	Y	Y	Y	Y
N	2,263	2,263	2,263	1,535

Notes: The level of observation is an episode-country ec, limited to episodes where at any point in time financial and trade sanctions coincide. For each episode e, the sample of countries c comprises the sanctioned country alongside all other countries that did not experience any sanction from one year before the first sanction starts up until one year after the year $t(e)$ the second type of sanction is implemented. In the fourth column, the sample is furthermore limited to countries with a ratio of bank deposits to GDP in excess of 10% one year before the first sanction starts. The dependent variable is the difference in the natural logarithm of a given country c's GDP one year after $t(e)$ vs. its GDP one year before the start of the first sanction. $\textit{Financial sanctions}_{c,t(e)}$ is a continuous measure of financial sanctions imposed on country c in year $t(e)$ weighted by the GDP of the sanctioning country. $\textit{Trade sanctions}_{c,t(e)}$ is defined analogously for trade sanctions. $\textit{Financial before trade sanctions}_{c,t(e)}$ is an indicator variable for whether financial sanctions preceded trade sanctions for a given episode e. Wherever indicated, we control for the number of years the first sanction has been in place before the second sanction is implemented, the GDP share of sanctioning countries imposing the second sanction in year $t(e)$ that have also imposed the first type of sanction in year $t(e) - 1$, and the GDP share of sanctioning countries imposing the first sanction in year $t(e)$ that have already done so in year $t(e) - 1$ (non-zero only for sanctioned countries). Continent by time period fixed effects are defined by the start year of an episode e and the year $t(e)$. Robust standard errors (double-clustered at the country and year ($t(e)$) levels) are in parentheses.

is an indicator variable for whether financial sanctions preceded trade sanctions for a given episode e. Finally, $\mathbf{X}_{c,t(e)}$ is a vector of episode-specific characteristics (non-zero only for sanctioned countries) measured at $t(e)$, δ_e are episode fixed effects, μ_c country fixed effects, and $\theta_{o(c)t(e)}$ continent by time period (comprising the start year of an episode e up until year $t(e)$) fixed effects. Standard errors are double-clustered at the country and year ($t(e)$) levels.

The results for the shorter post-sanction horizon $X = 1$ are in Table 4. The coefficient of interest is β_1, which captures whether episodes with financial sanctions preceding trade sanctions are more effective than episodes with the reverse order (captured by β_2). In particular, we control for observable characteristics between these two sequences, as detectable from Figure 1. In column 1, we control for the number of years before the second sanction is implemented, which we have seen to be much shorter when trade sanctions are preceded by financial sanctions (Panel A of Figure 1). Indeed, a longer pre-period for the preceding sanction is associated with greater GDP losses. After controlling for this, we find an adverse effect on GDP for episodes with financial sanctions preceding trade sanctions, which is significantly different from that for episodes with trade sanctions preceding financial sanctions.[2]

This continues to hold true in columns 2 and 3 where we additionally control for the GDP share of sanctioning countries imposing the second sanction in year $t(e)$ that have also imposed the first type of sanction in year $t(e) - 1$ and for the GDP share of sanctioning countries imposing the first sanction in year $t(e)$ that have already done so in year $t(e) - 1$, which are both higher for episodes where financial sanctions precede trade sanctions. In column 4, we show that these estimates are also relatively robust to dropping all countries starting with a low ratio of bank deposits to GDP (similar to Table 3), which is a criterion that should matter primarily when comparing across episodes that do not always include financial sanctions. Finally, the estimates are fairly similar for a one year longer horizon $X = 2$ (Table A.2 in the Appendix).

3 Sanctions in a Two-Country Model with Frictional Financial Intermediation

Our empirical results highlight the role of the sequence of financial and trade sanctions within an episode. We next show how a standard two-country New Keynesian model with an occasionally constrained financial sector can rationalize these findings. Our theoretical results demonstrate that imposing financial sanctions ahead of trade sanctions can strongly amplify the effect of the latter, whereas this is not true for the reverse order.

[2]Note that the latter can turn even positive because the effect is outweighed by the negative coefficient associated with the pre-period sanction duration, which is always non-zero. In addition, the (negative) sum of β_1 and β_2 is significant at the 1% level in columns 2 to 4.

3.1 Baseline Two-Country New Keynesian Model

We begin by introducing the basic equilibrium conditions of a two-country New Keynesian economy, merging the two-country New Keynesian setup of Bergin and Corsetti (2023) with a possibly constrained financial sector as in Gertler and Karadi (2011).

There are two countries, home (H) and foreign (F), which trade goods and financial assets with each other. Time is discrete, $t = 1, 2, \ldots$. There is no growth and we normalize the entire population to mass one. We allow countries to be heterogeneous and, in particular, to differ in size. We denote the share of H in the total population by n and the share of F by $1 - n$. When we refer to sanctions in our model, the home economy will always be the *sanctioning* country, and the foreign economy will be the *sanctioned* country. Sanctions are exogenous, i.e., the government of the sender country sets policies without considering its own households' welfare, pursuing solely the objective of harming the target.

The two-country setup allows us to include feedback effects of the sanctions. The reaction of the target to the sanction results in altered terms of trade (as in, e.g., Becko, 2024) and altered demand for the foreign (the sanctioning country's) goods and assets, thus entailing a general equilibrium response of the sender. By capturing the sanctioning country's reaction to these changes, our model yields an endogenous amplification or dampening of the sanction through these general equilibrium effects. For example, a trade sanction reduces consumption of imported goods in the sanctioned home country, which reduces income in the foreign economy, thereby reducing demand in the sanctioning foreign economy for imports from the home economy and further harming consumption in the sanctioned home economy, etc.

The introduction of a possibly constrained financial sector provides a rationale for the existence and effectiveness of financial sanctions. The financial sector consists of banks that channel deposits of households to firms who borrow to finance their capital stock. Banks are possibly constrained in doing so by their net worth because there is a moral-hazard problem between depositors and bankers. If bankers have sufficiently high levels of net worth, the moral-hazard problem does not lead to any frictions because bankers have sufficient collateral. Then, financial intermediation is effectively frictionless and household deposits can freely finance investments. However, if a financial sanction destroys part of the net worth of the banks in the sanctioned home economy, banks suddenly become constrained (due to an incentive constraint similar to Gertler and Karadi, 2011), thereby interrupting and reducing financial intermediation.

In the following, we derive the equilibrium conditions for the home economy H. They are analogous for the foreign economy F, for which we denote all associated variables by an asterisk. All variables are in nominal terms, denoted without an asterisk in H's currency and with an asterisk in F's currency, and the nominal exchange rate e_t is defined as units of home currency per one unit of foreign currency. The home economy is populated by a continuum of representative households indexed by $i \in [0, n]$ who maximize their expected utility from consumption C_t and leisure, provide labor L_t, and save in domestic and foreign deposits, B_{Ht} and B_{Ft}, respectively. The (non-financial) corporate sector is separated into four blocks, which essentially use labor L_t and capital K_t to produce a CES aggregate Y_t of differentiated goods for consumption, trade, and capital production. The financial sector uses deposits from domestic and foreign households to purchase firm equity in both countries, which is spent to buy capital. Note that we introduce sanction variables S_t^x as exogenous state variables throughout this paper.

Households. The representative household in the home economy has the separable utility function

$$U(C_t, L_t, B_{Ft}) = \frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{L_t^{1+1/\gamma}}{1+1/\gamma}, \tag{4}$$

where the parameters are the constant intertemporal elasticity of substitution, $\sigma > 0$, the constant Frisch elasticity of labor, $\gamma > 0$, and the scaling factor for disutility from labor $\chi > 0$. Households maximize their expected discounted utility,

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t, L_t, B_{Ft}), \tag{5}$$

with discount factor $\beta > 0$ subject to their budget constraint,

$$P_t C_t = W_t L_t + i_{St-1} B_{Ht-1} - B_{Ht} + \Pi_t + e_t i^*_{St-1} B_{Ft-1} - e_t B_{Ft}\,, \tag{6}$$

where W_t is the nominal wage, i_{St} and i^*_{St} are the nominal interest rates on deposits at domestic and foreign banks, respectively, and Π_t are profits obtained from firm ownership.

We derive the first-order conditions for the household and obtain the intertemporal Euler equation,

$$1 = \beta\, \mathbb{E}_t \left[\frac{i_{St}}{\pi_{t+1}} \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \right], \tag{7}$$

the labor supply condition,

$$\chi C_t^{\sigma} L_t^{\frac{1}{\gamma}} = \frac{W_t}{P_t}, \tag{8}$$

and the interest parity condition,

$$\mathbb{E}_t\left[\frac{1}{\pi_{t+1}}\left(\frac{C_{t+1}}{C_t}\right)^{-\sigma} i_{St}\right] = \mathbb{E}_t\left[\frac{1}{\pi_{t+1}}\left(\frac{C_{t+1}}{C_t}\right)^{-\sigma} \frac{e_{t+1}}{e_t} i^*_{St}\right]. \tag{9}$$

Trade. The consumption good C_t is obtained as a bundle of the domestic good C_{Ht} and the imported foreign good C_{Ft}:

$$C_t = \left(\nu^{\frac{1}{\eta}}(C_{Ht})^{\frac{\eta-1}{\eta}} + (1-\nu)^{\frac{1}{\eta}}(C_{Ft})^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}}, \tag{10}$$

where $\eta > 0$ is the elasticity of substitution, and $\nu = 1-(1-n)\zeta > 0$ is the home bias of the home economy with ζ being the openness parameter. Analogously, $\nu^* = 1 - n\zeta^*$ is the home bias of the foreign economy. By allowing for different values of trade openness and linking home bias to the size of the economy, we can capture differences between sanctioned and sanctioning countries.

The corresponding price index is

$$P_t = \left(\nu P_{Ht}^{1-\eta} + (1-\nu) P_{Ft}^{1-\eta}\right)^{\frac{1}{1-\eta}}, \tag{11}$$

and implies the following demand functions for domestic and foreign goods:

$$C_{Ht} = \nu\left(\frac{P_{Ht}}{P_t}\right)^{-\eta} C_t, \tag{12}$$

$$C_{Ft} = (1-\nu)\left(\frac{P_{Ft}}{P_t}\right)^{-\eta} C_t. \tag{13}$$

Note that the same aggregation function as in (10) applies below in both cases where firms use final goods from both countries as inputs for production (specifically for the production of capital and the intermediate good). Hence, the demand functions for domestic and foreign goods have the same structure as in (12) and (13).

Trade is generally subject to iceberg trade costs $\tau > 0$, which increase the price of the imports for the respective importing country because a fraction of the imported goods "melts" during transit. In the absence of trade sanctions, iceberg trade costs are the same in both directions (importing from home to foreign and from foreign to home) and result in the following domestic prices for imported goods (in home and foreign, respectively),

$$P_{Ft} = (1 + S_t^I)(1+\tau) e_t P_{Ft}, \tag{14}$$

$$P^*_{Ht} = (1 + S_t^X)\frac{1+\tau}{e_t} P_{Ht}, \tag{15}$$

where the trade sanctions S_t^I and S_t^X, set exogenously by the sender government, affect import prices, P_{Ft}, and export prices, P^*_{Ht}, respectively.

Corporate sector. Each economy's corporate sector produces one good, Y_t and Y_t^*. To allow for a clear characterization of frictions and mechanisms, we follow the presentation in Gertler and Karadi (2011) and split the corporate sector into four types of firms involved in production. The financial sector, which intermediates between consumers and the production side, is discussed thereafter.

The four types of firms are as follows: (i) competitive retailers that bundle a continuum of varieties; (ii) differentiators in monopolistic competition that produce varieties using the homogeneous intermediate good and are subject to price adjustment costs; (iii) capital goods producers that produce and refurbish capital; and (iv) competitive intermediate goods producers that produce the intermediate good using capital, labor and both final goods, and finance capital by equity. In a nutshell, this combined setting yields a Phillips curve, persistent reaction to shocks affecting capital, and one level of roundabout production capturing multiple channels for the reaction to changes in the terms of trade.

Retailers are competitive and bundle varieties $i \in [0, n]$ produced by differentiators using a CES technology,

$$Y_t = \left(\left(\frac{1}{n} \right)^{\frac{1}{\varepsilon}} \int_0^n Y_t(i)^{\frac{\varepsilon-1}{\varepsilon}} di \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{16}$$

where $\varepsilon > 0$ is the elasticity of substitution and $Y_t(i)$ is the amount of variety i purchased from the monopolistically competitive firm i at price $P_{Ht}(i)$. The CES aggregator yields standard demand functions for $Y_t(i)$,

$$Y_t(i) = \frac{1}{n} \left(\frac{P_{Ht}(i)}{P_{Ht}} \right)^{-\varepsilon} Y_t, \tag{17}$$

and the price of the domestic good,

$$P_{Ht} = \left(\frac{1}{n} \int_0^n P_{Ht}(i)^{1-\varepsilon} di \right)^{\frac{1}{1-\varepsilon}}. \tag{18}$$

There is a mass of size n of monopolistically competitive firms using the intermediate good Y_t^m to produce varieties $i \in [0, n]$ with a linear technology. They are subject to Rotemberg price adjustment costs, giving rise to the following pricing problem:

$$\max_{P_{Ht}(i)} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\Pi_{it}}{P_t}, \tag{19}$$

where Π_{it} are flow profits and

$$\Pi_{it} = \left(P_{Ht}(i) - P_{Ht}^m\right) Y_t(i) - \frac{\varepsilon}{2\kappa_Y} \left(\log \left(\frac{P_{Ht}(i)}{P_{Ht-1}(i)} \right) \right)^2 P_t Y_t, \tag{20}$$

i.e., revenues from selling $Y_t(i)$ minus costs of purchasing intermediate goods at price P_{Ht}^m as inputs and quadratic price adjustment costs. The latter are parameterized by $\kappa_Y > 0$, which sets the strength of the nominal price rigidity, and are scaled to the size of total revenues of the economy, $P_t Y_t$.

We only consider equilibria with symmetric price-setting for all i, i.e., we obtain $P_{Ht}(i) = P_{Ht}$ and $Y_t(i) = \frac{1}{n} Y_t$ for all i. Therefore, deriving the first-order condition yields the New Keynesian Phillips curve:

$$\log \pi_{Ht} = \beta \, \mathbb{E}_t \left[(\log \pi_{Ht+1}) \frac{\pi_{Ht+1}}{\pi_{t+1}} \frac{Y_{t+1}}{Y_t} \right] + \kappa_Y \left(\frac{P_{Ht}^m}{P_{Ht}} - \frac{\varepsilon - 1}{\varepsilon} \right). \tag{21}$$

Here, $\pi_{Ht} = \frac{P_{Ht}}{P_{Ht-1}}$ denotes the producer price inflation, i.e., inflation in the price of the domestic good, while $\pi_t = \frac{P_t}{P_{t-1}}$ denotes the consumer price index inflation, i.e., inflation in the price for the entire consumption basket as aggregated in (11).

Capital goods producers operate in a competitive market and use domestic and foreign final goods to produce new capital I_t^{net} and sell it to the intermediate goods producers at price q_t. New capital is equivalent to net investment in the economy and is subject to a quadratic investment adjustment cost. Additionally, they buy depreciated capital from the intermediate goods producers and repair it at unit cost. Profits are therefore only derived from selling new capital and are reduced by the corresponding adjustment cost:

$$\Pi_t^K = (q_t - P_t) I_t^{net} - \frac{\phi}{2} \left(\log \left(\frac{I_t^{net} + \psi}{I_{t-1}^{net} + \psi} \right) \right)^2 P_t \left(I_t^{net} + \psi \right). \tag{22}$$

Note that the capital goods producers use the same aggregate of domestic and foreign goods as the consumers, and as such also pay a price P_t for their inputs and the adjustment cost. The latter is parameterized by $\phi > 0$, which scales the investment friction, and by $\psi > 0$, which is a small constant added for numerical reasons. Maximizing expected discounted real profits similarly to (19) by choosing the level of new capital (all prices are taken as given) yields the following equilibrium condition:

$$\frac{q_t}{P_t} = 1 + \phi \log \left(\frac{I_t^{net} + \psi}{I_{t-1}^{net} + \psi} \right) + \frac{\phi}{2} \left(\log \left(\frac{I_t^{net} + \psi}{I_{t-1}^{net} + \psi} \right) \right)^2 - \beta \phi \, \mathbb{E}_t \left[\log \left(\frac{I_{t+1}^{net} + \psi}{I_t^{net} + \psi} \right) \frac{I_{t+1}^{net} + \psi}{I_t^{net} + \psi} \right]. \tag{23}$$

Since net investment is ultimately derived by the demand for capital, the equation above determines the price of new capital as a function of net investment.

Intermediate goods producers use capital K_t, labor L_t, and the CES aggregate of domestic and foreign goods X_t to produce the intermediate good, which is differentiated. They finance capital entirely through equity, which is bought by the financial sector. Specifically, at time $t-1$ the domestic and foreign financial sectors offer to buy A_{Ht} and A^*_{Ht} units of equity, respectively, at price q_{t-1}, thereby determining the amount of capital to be taken to the next period:

$$q_{t-1}K_t = q_{t-1}A_{Ht} + q_{t-1}\frac{1-n}{n}A^*_{Ht}. \tag{24}$$

Note that the factor $\frac{1-n}{n}$ emerges from heterogeneous country sizes and their consequently differently sized financial sectors.

Now, the firm chooses its labor demand and its demand for final goods based on a nested Cobb-Douglas production function,

$$Y_t^m = \left(Z_t\left(K_t\right)^{\alpha} L_t^{1-\alpha}\right)^{1-\upsilon} X_t^{\upsilon}, \tag{25}$$

with productivity level Z_t, capital share $\alpha > 0$, and $\upsilon > 0$, which is the share of final goods in production of the intermediate good. This dependence on the final goods adds one level of roundabout production, facilitating a direct effect of price changes in the final good on the input choices of the intermediate goods producers.

The maximization problem of the firm reads

$$\Pi_t^m = \max_{L_t, X_t} P_{Ht}^m Y_t^m - W_t L_t - P_t X_t\,, \tag{26}$$

implying a labor demand function,

$$L_t = \alpha(1-\upsilon)\frac{P_{Ht}^m}{W_t}Y_t^m, \tag{27}$$

and a demand function for final good inputs,

$$X_t = \upsilon\frac{P_{Ht}^m}{P_t}Y_t^m. \tag{28}$$

In total, the firm earns the following profits: Π_t^m from production, $-\delta P_t K_t$ from selling used capital to and buying refurbished capital from the capital goods producers, and $q_t K_t$ from liquidating capital. They repay all profits as return on equity, i_{Kt}, to the equity holders:

$$i_{Kt} = \frac{\Pi_t^m + q_t K_t - P_t \delta K_t}{q_{t-1} K_t} \tag{29}$$

$$= \frac{(1-\alpha(1-\upsilon)-\upsilon) P_{Ht}^m \frac{Y_t^m}{K_t} + q_t - \delta}{q_{t-1}}. \tag{30}$$

Financial sector. We consider financial sectors similar to the one in Gertler and Karadi (2011) for both countries, which each consist of a continuum of competitive leveraged banks owned by the households. Again only explicitly describing the home economy, the domestic banks use deposits B_{Ht} and B^*_{Ht} from domestic and foreign households, respectively, and their own net worth N_t to invest in equity in both countries, A_{Ht} and A_{Ft}.

However, the banks are subject to an incentive constraint, which introduces an endogenous leverage constraint to the optimization of the bank managers. In steady state, the leverage constraint is slack, meaning that there is perfect competition among banks for buying equity and, hence, the expected return on equity equals the risk-free interest rate.[3] Yet, any shock which increases bank leverage may make the constraint binding and increase the expected return on equity over the risk-free rate, thereby reducing the amount of capital used by the intermediate goods producers. In particular, we consider a financial sanction, S_t^{NW}, which destroys part of the target country's banks' net worth for this purpose.

Before introducing the model equations, we briefly discuss two features of having separate financial sectors in both countries. First, we allow for cross-border financial flows, i.e., households have deposits in both financial sectors and both financial sectors buy equity in both countries. This makes the financial sectors sensitive to the other economy. Second, we can parameterize the financial sector such that we account for the idea that target countries of sanctions tend to have smaller financial sectors and differently structured balance sheets.

The balance sheet of the domestic financial sector is given by

$$q_t A_{Ht} + e_t q_t^* A_{Ft} = P_t N_t + B_{Ht} + \frac{1-n}{n} RER_t B^*_{Ht}, \tag{31}$$

where the household-level savings B^*_{Ht} are scaled according to the different size of both countries.

The banks face a portfolio choice problem in that they have the choice between two possible assets, A_{Ht} and A_{Ft}. We impose a reduced-form approach to this problem by assuming that bank managers gain utility from a CES aggregate of both types of assets,

[3] This is also a slight deviation from Gertler and Karadi (2011) who parameterize their model such that the leverage constraint is always binding.

and derive the respective demand functions accordingly. The respective CES aggregators are as follows:

$$A_t = \left(\nu_Q^{\frac{1}{\eta}} A_{Ht}^{\frac{\eta-1}{\eta}} + (1-\nu_Q)^{\frac{1}{\eta}} A_{Ft}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, \tag{32}$$

$$Q_t = \left(\nu_Q q_t^{1-\eta} + (1-\nu_Q) q_t^{*1-\eta} \right)^{\frac{1}{1-\eta}}. \tag{33}$$

These definitions yield analogous demand functions for A_{Ht} and A_{Ft} as for consumption in equations (12) and (13). We parameterize the aggregators with the same elasticity of substitution between assets, η, as for consumption but replace the home bias ν by the banking home bias $\nu_Q \in [0,1]$ (and ν_Q^* for foreign banks). This allows us to model the preference and ability of the domestic banks to invest in the foreign corporate sector independent of the domestic demand for foreign goods.

Banks pay out the risk-free rate i_{St} on deposits, and earn the return on equity i_{Kt} on domestic and i_{Kt}^* on their foreign assets, yielding a law of motion for bank net worth for each individual bank. Together with the mortality risk $1-\theta > 0$ and the net worth of newly funded banks, which receive a share $\omega > 0$ of assets in $t-1$, we obtain the law of motion for the entire financial sector's net worth:

$$\begin{aligned} P_{t+1}N_{t+1} &= \theta S_t^{NW} \left(i_{Kt} q_{t-1} A_{Ht-1} + i_{Kt}^* q_{t-1}^* A_{Ft-1} - i_{St}(B_{Ht-1} + \frac{1-n}{n} RER_t B_{Ht-1}^*) \right) + \omega Q_t A_t \\ &= \theta S_t^{NW} \left(lev_t i_{Kt}^{agg} + (1-lev_t) i_{St} \right) P_t N_t + \omega \frac{Q_t}{\pi_t} A_t, \end{aligned} \tag{34}$$

where i_{Kt}^{agg} is the weighted mean of i_{Kt} and i_{Kt}^*, and S_t^{NW} is the financial sanction, which in this case directly reduces the net worth of the surviving banks. The leverage ratio, $lev_t = \frac{Q_t A_t}{P_t N_t}$, is subject to an endogenously determined leverage constraint

$$lev_t \leq \frac{\rho_t}{\lambda}, \tag{35}$$

with $\lambda > 0$ being the maximal share of assets the bank manager can divert and ρ_t constraining the leverage such that the bank manager does not divert,

$$\rho_t = \frac{\beta \left(1-\theta+\theta\, \mathbb{E}_t[\rho_{t+1}]\right) i_{St}}{\pi_t - \frac{\beta}{\lambda}\left(1-\theta+\theta\, \mathbb{E}_t[\rho_{t+1}]\right)\left(i_{St} - i_{Kt+1}^{agg}\right)}. \tag{36}$$

We calibrate our model such that (35) is not binding in steady state, i.e., if the households increase their savings, these deposits are directly transformed into new equity and, hence, capital (adhering to the respective general equilibrium price responses).[4] In this sense, there is perfect competition among banks for opportunities to buy equity, which reduces

[4]The according parameter condition for a steady-state slack leverage constraint is $\frac{\omega}{\lambda} + \frac{\theta}{\beta} > 1$.

the profit margin of equity to zero and implies

$$\mathbb{E}_t \, i^{agg}_{Kt+1} = i_{St}, \tag{37}$$

i.e., the expected return on equity is equal to the risk-free rate.

If the leverage constraint becomes binding, then (37) is omitted, (35) holds with equality, and $\mathbb{E}_t \, i^{agg}_{Kt+1}$ is implicitly determined by (36). In this case, there is a positive spread between i_{St} and $\mathbb{E}_t \, i^{agg}_{Kt+1}$, which yields a faster build-up of net worth, eventually leading the financial sector out of the constrained regime again.

Aggregation and market clearing. We conclude the presentation of our model with its market-clearing conditions. The aggregate capital law of motion is

$$K_{t+1} = K_t + I^{net}_t, \tag{38}$$

summing up capital after depreciation, $(1-\delta)K_t$, refurbished capital, δK_t, and newly produced capital equal to net investment, I^{net}_t, to obtain the capital stock, which is taken to the next period. The total demand for the domestic good must equal its supply Y_t, i.e.,

$$Y_t = C_{Ht} + I^{net}_{Ht} + X_{Ht} + S^X_t (1+\tau) \frac{1-n}{n} \left(C^*_{Ht} + I^{net*}_{Ht} + X^*_{Ht} \right), \tag{39}$$

where we again scale the foreign demand for the domestic good by the relative size of the countries. Profits of all firms and the financial sector are transferred back to the households as a lump sum and amount to

$$\Pi_t = \left(P_{Ht} - P^m_{Ht}\right) Y_t + (q_t - 1) I^{net}_t + (1-\theta) \left(lev_t i^{agg}_{Kt} + (1 - lev_t) i_{St}\right) \frac{N_t}{\pi_t} - \omega \frac{Q_t}{\pi_t} A_t. \tag{40}$$

We close the model with a standard Taylor rule for monetary policy:

$$i_{St} = i^{\rho_{mp}}_{St-1} \left(\frac{\pi_t}{\overline{\pi}_t} \right)^{\phi_\pi (1-\rho_{mp})}, \tag{41}$$

where ρ_{mp} parameterizes the interest rate smoothing and ϕ_π is the Taylor coefficient. Note that deposit market clearing is given by the aggregated balance sheet of the financial sector in (31).

3.2 Calibration

We calibrate our model using standard values from the literature, focusing on the heterogeneity across sender and target countries. We calibrate to annual frequency. We

Table 5: Calibrated Parameters (Baseline)

Parameter	Description	Value	Source
β	Discount factor	0.96	baseline
σ	Relative risk aversion	1.5	FLLR
χ	Disutility weight of labor	3.4	GK11
γ	Frisch elasticity	3.623	GK11
θ	Bank survival ratio	0.972	FLLR/GK11
θ^*	Bank survival ratio	0.972	FLLR/GK11
ω	Transfer to the new bankers (target)	0.002	FLLR/GK11
λ	Divertible fraction of capital (home)	0.14	baseline
λ^*	Divertible fraction of capital (foreign)	0.1	baseline
$\bar{B}_F$	Steady state holdings of foreign deposits (target)	0.01	baseline
$\bar{B}^*_H$	Steady state holdings of foreign deposits (sender)	0.01	baseline
ν_Q	Financial sector home bias (target)	1	baseline
ν^*_Q	Financial sector home bias (sender)	0.99	baseline
ϵ	Elasticity of substitution (differentiated goods)	4.167	BC23
κ_y	Price stickiness	0.09	FLLR
ϕ	Inverse elasticity of net investment to price of capital	1.728	GK11
δ	Capital depreciation	0.06	baseline
ψ	Small offset for numerical stability	0.141	GK11
α	Labor share in production	0.67	FLLR
ρ_{mp}	Interest rate smoothing	0.7	FLLR
ϕ_π	Response of monetary policy to inflation	1.50	FLLR
ζ	Openness of the economy	0.5	baseline
η	Elasticity of substitution (domestic & foreign goods)	5.2	BC23
τ	Iceberg trade costs in steady state (towards target)	0.44	BC23
τ^*	Iceberg trade costs in steady state (towards sender)	0.44	BC23
n	Size of target	0.1	baseline
ν	Home bias (target)	0.55	from n and ζ
ν^*	Home bias (sender)	0.95	from n and ζ
υ	Final good input share in production	0.5	baseline

generally follow the calibration in Gertler and Karadi (2011) (GK11) and Faccini et al. (2020) (FLLR) for parameters reflecting the internal features of the economy, and the calibration in Bergin and Corsetti (2023) (BC23) for parameters that govern the trade relations between both countries.

We summarize our parameterization in Table 5. To safeguard that the financial sector is unconstrained in steady state, we set $\lambda = 0.14$ (instead of $\lambda = 0.381$ in GK11 and FLLR); this makes the leverage constraint slack but still allows the sanctioning government to use financial sanctions to constrain the financial sector of the target country. To account for the fact that targets have less developed, or smaller, financial sectors—as is the case in many developing countries—compared to sender economies, we set $\lambda^* = 0.1$ for the foreign economy, thus increasing the size of the banking sector in the sender economy relative to the one in the target economy.

3.3 Implementation of Sanctions

We first need to define trade and financial sanctions, given the range of measures that fall under these categories empirically.

We model trade sanctions as increases in iceberg trade costs between the target and sender countries. In our model, these increases are captured by the sanction shocks S_t^I and S_t^X. This approach captures the idea that under trade sanctions a country might still have some access to trade, re-routing its trade flows. Felbermayr et al. (2020) demonstrate how trade flows respond to different types of trade sanctions—whether import or export, partial or complete. By using empirical trade elasticities, these trade-flow changes can be translated into an equivalent counterfactual tariff increase similar to iceberg costs that would result in the same trade-flow reduction. Their estimates suggest that these tariff increases range from 14% to 45.8%.

To capture the idea that short-run elasticities are typically lower than long-run elasticities, we assume that trade sanctions have ever declining effects over time, so that the increase in iceberg costs follows

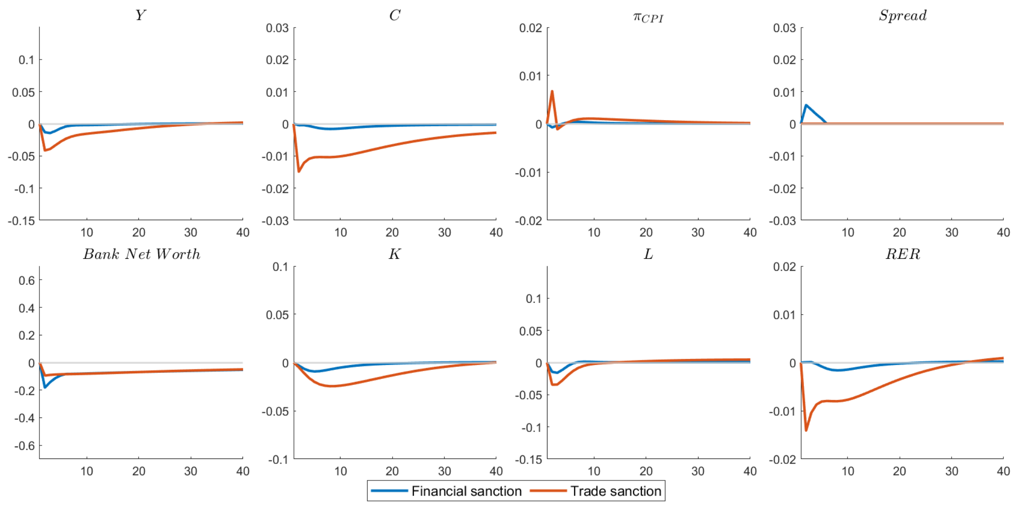
$$S_t^I = \varrho S_{t-1}^I \tag{42}$$

$$S_t^X = \varrho S_{t-1}^X, \tag{43}$$

starting with $S_1^I = S_1^X$. Concretely, we set the initial sanctions shock to 10% and ϱ to 0.9.

We model financial sanctions in a similarly stylized way. In practice, financial sanctions are often implemented as a package of policies targeting specific (financial and non-financial) firms, sectors, or individuals. These measures can include asset freezes or restrictions on new investments in the target country. We capture these dimensions as a

Figure 2: Response to Sanctions



Notes: (Non-linear) Impulse response to a sanction. *Trade*: 8 percentage point increase in iceberg trade costs in both directions ($S_t^X = S_t^I = 0.08$) in period $t = 1$. *Financial:* 10% reduction in bank net worth in the home economy. All variables in real terms as described in the model.

worsening of the moral-hazard problems in the home financial sector, which we model as a decline in the banking sector's net worth, e.g., because the foreign wealth of bankers can no longer serve as collateral.

Specifically, after the sanction, the banking sector's net worth is reduced to

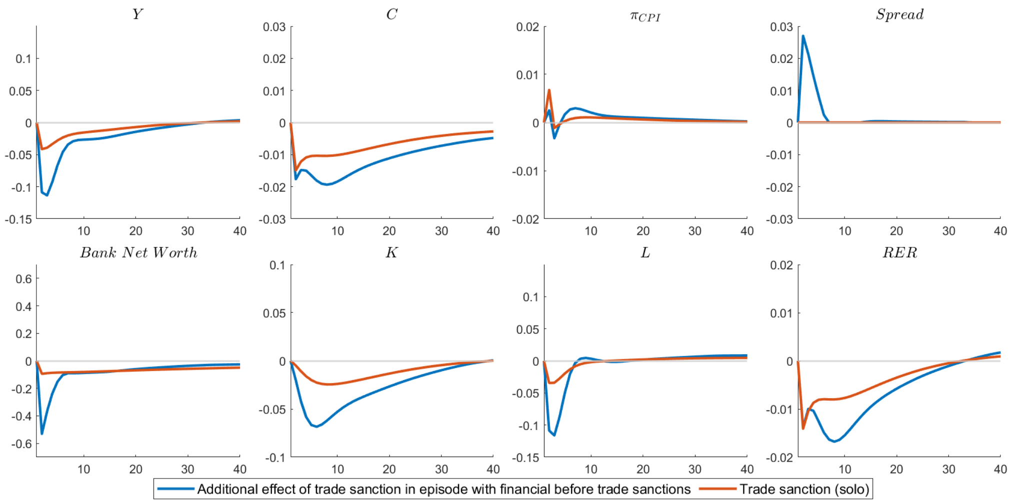
$$N_{t+1} = N_{t+1}^{new} S_t^{NW}, \tag{44}$$

where N_{t+1}^{new} is the net worth derived from the previous period's assets (see equation (34)). The term S_t^{NW} reflects the lost franchise value of the respective banks. Since our baseline calibration deliberately chooses an abundant level of net worth in the financial sector, such that normally the collateral constraint does not bind, it requires a sufficiently large sanction shock for financial sanctions in our model to have any effect at all.

3.4 Aggregate Responses to Sanction Shocks

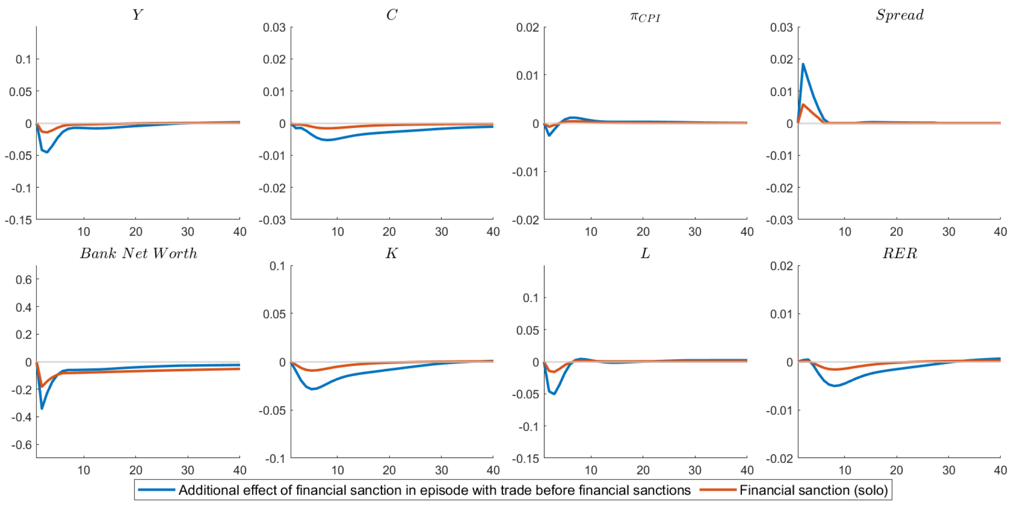
We solve the model under perfect foresight for the trade and the financial sanctions separately (see Figure 2). That is, we do not analyze the effect that the risk of sanctions may have, but view (further) sanctions as zero-probability events from the point of view of the sanctioned and sanctioning country. Trade sanctions equivalent to an 8 percentage point increase in trade costs decrease output by 4% in the sanctioned economy, which is in line with similar exercise in Bergin and Corsetti (2020). This is largely driven by a decrease in export demand, so that consumption falls with close to 4% less, but

Figure 3: Financial before Trade Sanctions: Net-Worth Shock



Notes: Reaction functions to a 10% shock to bank net worth ($S_t^{NW} = 0.9$) in period $t = -4$ and a 8% shock to iceberg trade costs in both directions ($S_t^X = S_t^I = 0.08$) in period $t = 1$, with baseline calibration from Table 5.

Figure 4: Trade before Financial Sanctions: Net-Worth Shock



Notes: Reaction functions to a 8% shock to iceberg trade costs in both directions ($S_t^X = S_t^I = 0.08$) in period $t = -4$ and a 10% shock to bank net worth ($S_t^{NW} = 0.9$) in period $t = 1$, with baseline calibration from Table 5.

still substantially. The financial sanction alone has only mild effects in the sanctioned economy. In the absence of other sanctions, only the acquisition of new capital is affected and only to a modest extent. Consequently, output falls by less than 1% and consumption is virtually invariant. We have calibrated the financial sanction to be large enough to trigger the leverage constraint, which we have picked so that the home economy has a well-functioning financial sector in the absence of sanctions even when otherwise large shocks hit the economy.[5] Our empirical evidence, however, did underscore the crucial interaction and sequence of trade and financial sanctions in determining their impact on GDP in the target country. To account for this, we now let the economy be hit by one of the shocks four years earlier than the other. Of course, the effect of two sanctions is always stronger than the effect of just one sanction. What we are interested in is the *additional* effect and understanding if the model can replicate the nonlinearities in the data.

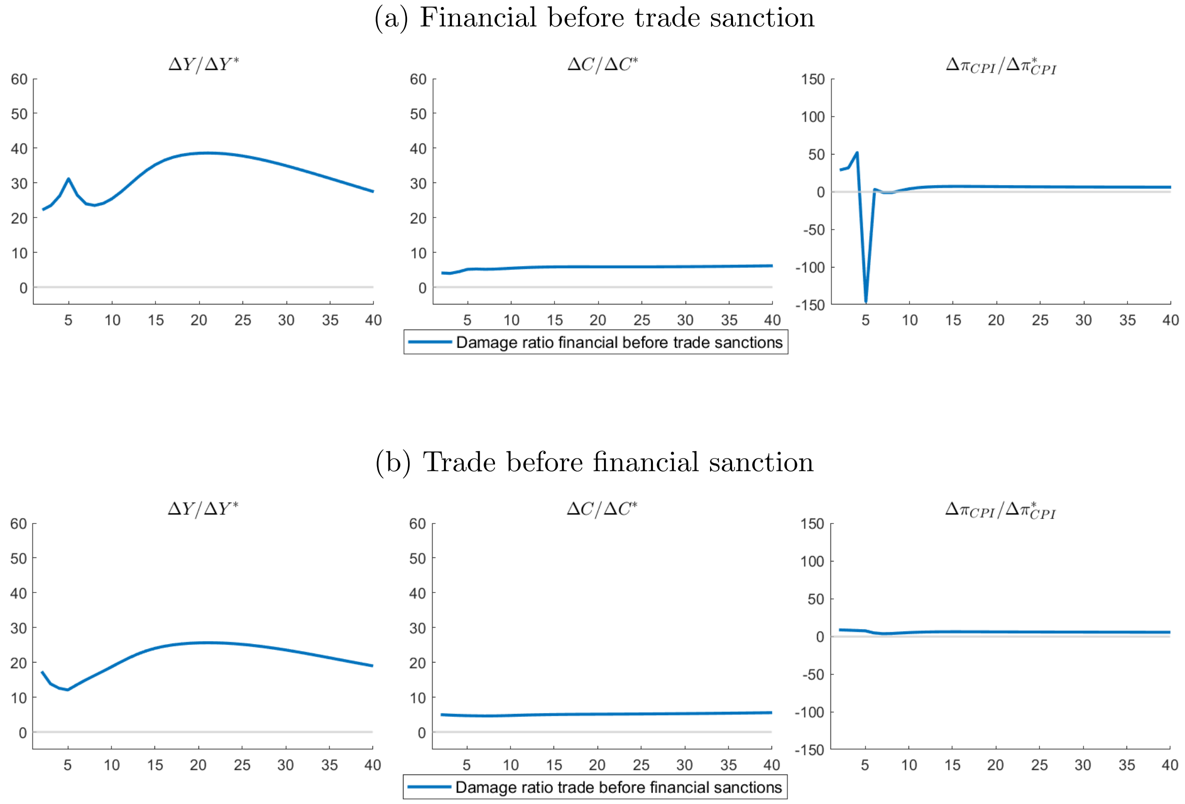
Again we solve under the assumption of perfect foresight but such that the second sanction comes as a surprise. Figure 3 compares the effect of a pure trade sanction to the *additional* effect of a trade sanction after a financial sanction over the effect of the pure financial sanction (as in Figure 2). Vice versa, Figure 4 compares the effect of a pure financial sanction to the *additional* effect of a financial sanction after a trade sanction over the effect of the pure trade sanction (as in Figure 2).

In the scenario with trade before financial sanctions, a trade sanction is imposed at $t = -4$ and a financial sanction at $t = 1$, while the order is reversed in the alternative scenario. This means we assume a lag of four years between the two sanctions, motivated by the considerable lag between the imposition of each type of sanctions as documented empirically in Figure 1. However, note that our empirical results suggest that the exact length of the pre-period has a negligible effect.

We find, in line with the data, that imposing financial sanctions before trade sanctions significantly amplifies the effect of trade sanctions, while there is hardly any amplification for the reverse ordering. The reason for this is relatively straightforward. We know from Gertler and Karadi (2011) that there is a significant amplification of demand shocks from a constrained financial sector—Keynesian effects become more important through a financial accelerator. The financial sanction (if strong enough) moves the financial sector into a constrained regime such that the damage of the trade sanction is amplified. Under the reverse ordering, Keynesian effects of the trade sanctions have mostly died out after four years and prices have adjusted. This means that there is not much of a Keynesian effect to amplify when the financial sanction moves the banking sector towards the constraint. Having said this, the additional effect on consumption is smaller but more protracted. Moving the financial sector towards the constraint means that investment

[5] In our model, a 10% loss of net worth is insufficient to trigger the leverage constraint, so that for any smaller sanction shock the impact on the economy is negligible (see Figure B.1 in the Appendix).

Figure 5: Cumulative Damage Ratios



Notes: Cumulative damage ratios for a 8% shock to trade costs and a 10% shock to bank net worth. *Top panel:* Financial sanction hits in period $t = -4$ and trade sanction in period $t = 1$. *Bottom panel:* Reverse order.

activity is hampered, but this—much like the decline in export demand—implies there are more resources for consumption all else equal. Only when lower investment translates into a decline in capital does consumption drop above and beyond what would be implied by the sum of the two sanctions alone.

These results hinge on the strength of the financial sanction, as can be seen by considering a weaker financial sanction in the form of a smaller shock to the financial sector's net worth. The trade sanction is amplified only if the financial sanction is actually strong enough to make the leverage constraint of the banking sector binding; otherwise, the small stand-alone effect of the financial sanction on GDP just adds up to the effect of the trade sanction, which does not trigger the mechanism discussed above (see Figures B.2, and B.3 in the Appendix for the corresponding impulse response functions).

Finally, although we model sanctions as exogenous decisions by the foreign country's government, in practice, the relative damage inflicted, particularly in relation to the harm incurred by the sender economy, is a key factor in assessing the sanction's success and continuation. To evaluate this, we compare the cumulative damages in the sanctioned country to those in the sanctioning country, in the same way one calculates government spending multipliers.

Specifically, for a given variable X, we calculate the cumulative loss in the target economy for each unit of cumulative loss in the corresponding variable in the sender economy, X^*, yielding the cumulative damage ratio in a given period t:

$$\mu_t = \frac{\sum_{\tau=1}^{t}(X_\tau - \bar{X})}{\sum_{\tau=1}^{t}(X_\tau^* - \bar{X}^*)}, \tag{45}$$

where $\bar{X}$ and $\bar{X}^*$ represent the steady-state values of a given variable X in the target and sender economies, respectively.

Figures 5a and 5b show the results. Across all variables, the damage ratio is significantly larger than one, which results from the fact that we calibrated the home country to be small relative to the sanctioning foreign country. Importantly, in terms of output losses and inflation, we find a strong improvement of the cumulative damage ratios if there is a successful (i.e., large enough) financial sanction that precedes the trade sanction. In terms of consumption, the effect is again small.

4 Conclusion

This paper investigates the effectiveness of sanction episodes and in doing so, zooms in on two dimensions: the combination of trade and financial sanctions as well as the order of their sequence. Using comprehensive data at the country-year level, we establish that conditional on both types of sanctions eventually being in place, the detrimental effect on the target country's economy upon implementing the second type of sanction is greater when financial sanctions precede trade sanctions than the other way around. To rationalize these patterns, we present a two-country New Keynesian model and complement it with frictional financial intermediation as in Gertler and Karadi (2011).

Our model highlights that what financial sanctions do is impede the macroeconomic role of the financial sector, which is to channel investment to its most effective use and, thus, pivotal for long-run growth. We abstract in our analysis both empirically as well as in the theoretical model from such growth effects. Instead, we highlight that a financial sector, adversely affected by sanctions, can have a destabilizing effect on the entire economy by amplifying external shocks. In a sanction scenario, such external shocks are not fully random but include in particular trade shocks, the business cycle effects of which are then amplified by a constrained financial sector.

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ONLINE APPENDIX

A Supplementary Tables

Table A.1: Asymmetric Effects of Combined Sanctions after 2 Years

	$\ln(GDP_{c,t})$		
'before' cutoff	1 year	1 year	2 years
	(1)	(2)	(3)
Financial sanctions × Trade sanctions	-0.670*	-0.741*	-0.789**
× Financial *before* trade sanctions	(0.386)	(0.380)	(0.391)
Financial sanctions × Trade sanctions	0.146	0.114	-0.027
× Trade *before* financial sanctions	(0.228)	(0.224)	(0.182)
Financial sanctions × Trade sanctions	0.410*	0.496*	0.541*
	(0.235)	(0.258)	(0.302)
Financial sanctions (2 years before)	-0.296**	-0.297*	-0.289
	(0.125)	(0.167)	(0.178)
Financial sanctions (3 years before)		-0.011	0.036
		(0.138)	(0.121)
Financial sanctions (4 years before)			-0.031
			(0.142)
Trade sanctions (2 years before)	-0.378*	-0.331*	-0.340
	(0.214)	(0.179)	(0.206)
Trade sanctions (3 years before)		-0.083	-0.034
		(0.113)	(0.095)
Trade sanctions (4 years before)			-0.073
			(0.113)
Country FE	Y	Y	Y
Continent-Year FE	Y	Y	Y
N	2,249	2,068	1,914

Notes: The level of observation is a country-year ct. The sample is limited to countries with an average ratio of bank deposits to GDP in excess of 10%. The dependent variable is the natural logarithm of country c's GDP in year t. *Financial sanctions*$_{c,t-2}$ is constructed as the GDP-weighted fraction of countries imposing financial sanctions on country c in the year $t-2$. *Trade sanctions*$_{c,t-2}$ is the analogously constructed weighted average for trade sanctions. *Financial before trade sanctions*$_{c,t-2}$ is an indicator variable for whether any financial sanctions were implemented one year (in columns 1 and 2) or two years (column 3) before any trade sanctions were, conditional on both financial and trade sanctions being in place in country c and year $t-2$. *Trade before financial sanctions*$_{c,t-2}$ is defined analogously. Robust standard errors (double-clustered at the country and year levels) are in parentheses.

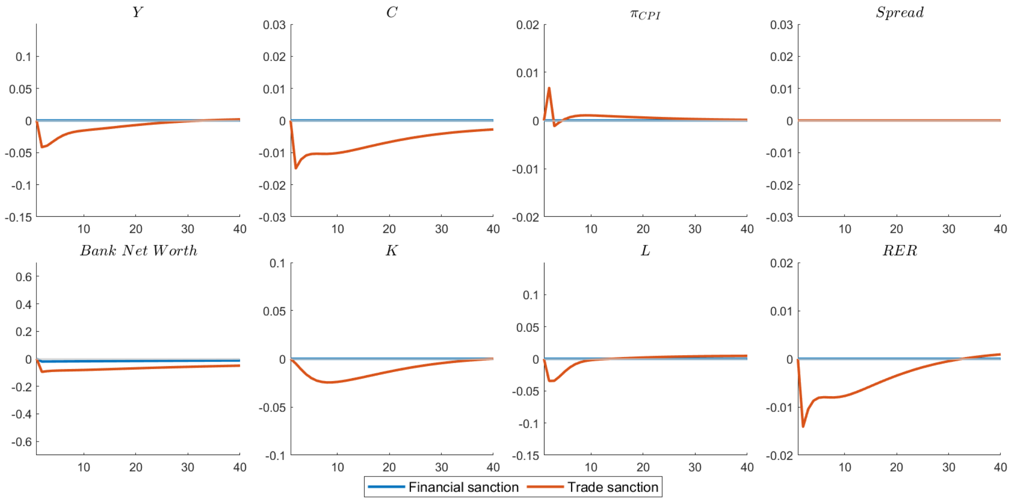
Table A.2: Asymmetric Effects of Combined Sanctions: Episode by Country Level—Longer Horizon

	$\Delta\ln(GDP)_{ec}^{t(e)+2,-1}$			
Sample				Financially developed
	(1)	(2)	(3)	(4)
Financial sanctions × Trade sanctions	-5.509*	-6.529**	-6.666**	-9.127
× Financial before trade sanctions	(2.888)	(2.991)	(3.028)	(6.991)
Financial sanctions × Trade sanctions	5.027*	5.874*	6.010*	8.329
	(2.845)	(3.010)	(3.049)	(7.444)
No. of years before second sanction	-0.052***	-0.059***	-0.060***	-0.076*
	(0.011)	(0.009)	(0.010)	(0.040)
GDP share second & first sanction		0.218	1.755**	3.092*
		(0.164)	(0.650)	(1.754)
GDP share first sanction before & after			-1.544**	-3.123*
			(0.736)	(1.676)
Episode FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
Continent-Time FE	Y	Y	Y	Y
N	2,046	2,046	2,046	1,360

Notes: The level of observation is an episode-country ec, limited to episodes where at any point in time financial and trade sanctions coincide. For each episode e, the sample of countries c comprises the sanctioned country alongside all other countries that did not experience any sanction from one year before the first sanction starts up until two years after the year $t(e)$ the second type of sanction is implemented. In the fourth column, the sample is furthermore limited to countries with a ratio of bank deposits to GDP in excess of 10% one year before the first sanction starts. The dependent variable is the difference in the natural logarithm of a given country c's GDP two years after $t(e)$ vs. its GDP one year before the start of the first sanction. *Financial sanctions*$_{c,t(e)}$ is a continuous measure of financial sanctions imposed on country c in year $t(e)$ weighted by the GDP of the sanctioning country. *Trade sanctions*$_{c,t(e)}$ is defined analogously for trade sanctions. *Financial before trade sanctions*$_{c,t(e)}$ is an indicator variable for whether financial sanctions preceded trade sanctions for a given episode e. Wherever indicated, we control for the number of years the first sanction has been in place before the second sanction is implemented, the GDP share of sanctioning countries imposing the second sanction in year $t(e)$ that have also imposed the first type of sanction in year $t(e) - 1$, and the GDP share of sanctioning countries imposing the first sanction in year $t(e)$ that have already done so in year $t(e) - 1$ (non-zero only for sanctioned countries). Continent by time period fixed effects are defined by the start year of an episode e and the year $t(e)$. Robust standard errors (double-clustered at the country and year ($t(e)$) levels) are in parentheses.

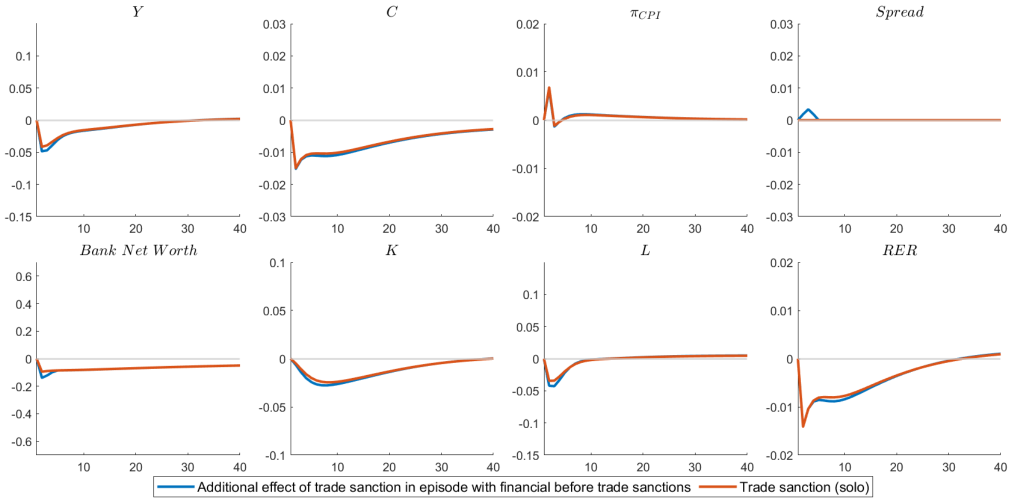
B Supplementary Figures

Figure B.1: Weak Financial Sanction



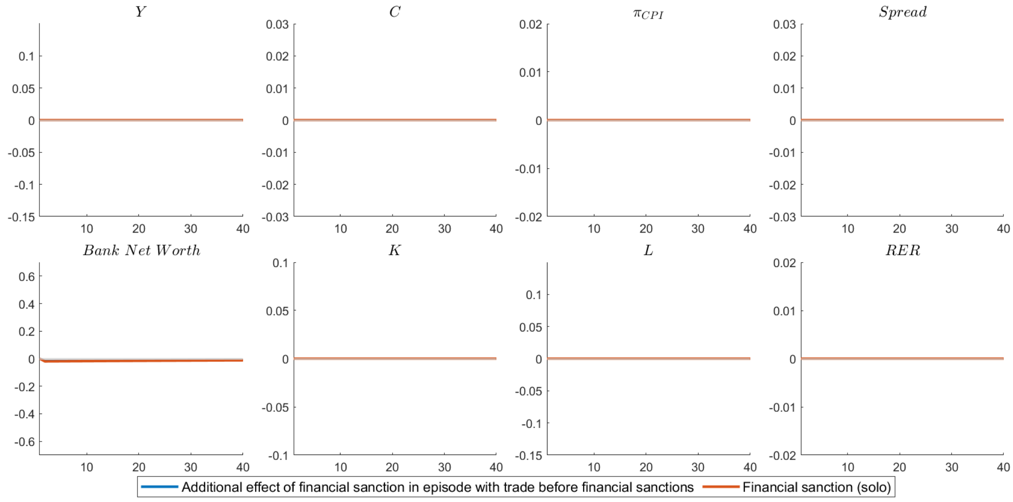
Notes: (Non-linear) Impulse response to a sanction. *Trade*: 8 percentage point increase in iceberg trade costs in both directions ($S_t^X = S_t^I = 0.08$) in period $t = 1$. *Financial:* 2% reduction in bank net worth in the home economy. All variables in real terms as described in the model.

Figure B.2: Weak Financial before Trade Sanctions



Notes: Reaction functions to a 2% shock to bank net worth ($S_0^{NW} = 0.98$) in period $t = -4$ and a 8% shock to iceberg trade costs in both directions ($S_0^X = S_0^I = 0.08$) in period $t = 1$, with baseline calibration from Table 5.

Figure B.3: Trade before Weak Financial Sanctions



Notes: Reaction functions to a 8% shock to iceberg trade costs in both directions ($S_0^X = S_0^I = 0.08$) in period $t = -4$ and a 2% shock to bank net worth ($S_0^{NW} = 0.98$) in period $t = 1$, with baseline calibration from Table 5.