The long-run costs of trade wars: evidence from the late nineteenth century*

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August 29, 2026

Abstract

Empirical evidence on the consequences of trade wars is largely confined to short-run horizons, leaving the long-run costs largely unknown. We study the trade war between Italy and France (1888–1898), a sharp bilateral disruption in trade policy for which data are available over more than two decades after its onset. Combining structural gravity estimation, a multi-country general equilibrium model, and synthetic control methods, we find that trade between Italy and France fell by about 58% during the conflict and remained at similarly depressed levels up to the eve of the First World War. The bilateral collapse was only weakly offset through reallocation toward third markets. As a result, Italy's total trade remained roughly 12–16% below its counterfactual level. This conclusion is stable across alternative calibrations and closely aligned with an independent synthetic-control counterfactual, providing a long-run empirical benchmark for assessing the aggregate consequences of trade wars.

Keywords: Trade war; trade fragmentation; first globalization; protectionism

JEL codes: F13, F14, F62, N74

*In writing this paper we have benefited from comments by Carla Salvo, Markus Lampe, Pablo Martinelli, Antonio Tena, Giovanni Federico, Carlos Sanz, Florens Odendahl, Luis Pérez. Marcela Sabaté, Alessandra Pasquini, Federico Barbiellini Amidei, Ludovic Panon, and by participants at the Figuerola Institute Annual Workshop 2024, the XIV International Congress of the Spanish Association of Economic History (AEHE), the University of Zaragoza Workshop "Interests, politics, and trade treaties, 1834-1959", the Banco de España research seminar, the XIV International Congress of the Spanish Association of Economic History, and the 10$^{\text{th}}$ Associazione di Storia Economica (ASE) Meeting for helpful comments and suggestions. The views expressed in this paper are those of the authors and do therefore not necessarily reflect those of the Banco de España, Banca d'Italia, or the Eurosystem. Iliana Reggio acknowledges funding by Ministerio de Ciencia, Innovación y Universidades, Grant PID2024-161540NB-I00. Corresponding author: Jacopo Timini, jacopo.timini@bde.es.

1 Introduction

Trade wars and broader forms of trade fragmentation have become central to economic policy debates in recent years. While a large literature has documented the gains from trade integration, much less is known about the consequences of reversing integration through higher trade barriers. In particular, there is limited empirical evidence on whether disruptions to established trading relationships generate only temporary dislocations or instead leave persistent effects on trade patterns and aggregate outcomes.

Existing evidence faces two main limitations. First, recent episodes such as Brexit and the U.S.–China trade war are informative but observed over relatively short post-event horizons, making it difficult to assess whether their effects persist (e.g., Kren and Lawless, 2024; Amiti et al., 2019; Fajgelbaum et al., 2020; Fajgelbaum and Khandelwal, 2022; Fajgelbaum et al., 2024). Second, much of the available evidence relies on quantitative trade models that are calibrated under the assumption that increases and decreases in trade costs have symmetric effects (Yotov et al., 2016; Dhingra et al., 2017). As a result, there are still relatively few empirical benchmarks on the long-run consequences of rising trade barriers.

This paper addresses this gap by studying the trade war between Italy and France (1888–1898). This episode provides a useful setting to analyze the consequences of a sharp bilateral increase in trade barriers. The breakdown of a long-standing trade agreement abruptly disrupted one of Italy's most important trading relationships (Federico and O'Rourke, 2001). Importantly, the availability of data over more than two decades after the onset of the conflict allows us to trace the evolution of trade flows well beyond the initial shock and to assess whether its effects were temporary or persistent.

We find large and persistent reductions in bilateral trade. Trade between Italy and France fell by about 58% during the conflict and remained at similarly depressed levels up to the eve of the First World War. This bilateral collapse was not substantially absorbed through reallocation toward third markets. Across alternative calibrations of the general equilibrium model, the implied degree of trade diversion remains limited, and an alternative synthetic-control counterfactual yields closely aligned aggregate patterns. Using a multi-country general equilibrium model disciplined by the bilateral estimates, we infer that Italy's total trade remained about 12–16% below its counterfactual level over the period we analyze.

To study these effects, we combine three complementary approaches. First, we estimate a structural gravity model to identify the impact of the trade war on bilateral trade flows within a theory-consistent framework. Second, we embed these estimates in a multi-country general equilibrium model to infer the aggregate implications for total trade, accounting for trade diversion and general equilibrium adjustments. Third, we apply a synthetic control method to construct data-driven counterfactuals for bilateral trade shares, providing an alternative approach that does not rely on the parametric structure of the gravity model. Together, these methods allow us to assess whether the bilateral disruption was largely reabsorbed through trade diversion or instead translated into persistent aggregate losses under complementary identifying assumptions.

This paper contributes to the literature on trade wars and broader forms of trade fragmentation. Recent empirical work has examined episodes such as Brexit or the U.S.–China trade war, while a related strand of research uses quantitative trade models to simulate the effects of rising trade barriers.[1] More recently, a related literature has emphasized the role of geopolitical tensions as a driver of trade fragmentation, documenting how political alignment and strategic considerations shape trade patterns.[2] Our contribution to this literature is to provide evidence on the long-run consequences of rising trade barriers using a historical episode in which trade policy was closely intertwined with geopolitical tensions and adjustment can be observed over an extended horizon. In doing so, the paper provides an empirical benchmark that can help discipline model-based analyses of trade fragmentation, particularly with respect to how much bilateral trade disruption is likely to be offset through reallocation toward third markets over longer horizons. Unlike most contemporary episodes, this setting allows us to observe adjustment over a sufficiently long horizon to distinguish temporary disruption from persistent reorganization of trade. More broadly, the paper contributes to the literature on the economic effects of trade policy by shifting attention from the gains of integration to the costs of disintegration.

The paper also contributes to the economic history literature on trade policy and economic development in the late nineteenth century. Previous work has documented the evolution of Italy's trade patterns and degree of openness, as well as the role of trade policy in shaping economic performance.[3] However, existing studies have not provided a systematic quantitative assessment of the bilateral and aggregate effects of the Franco-Italian trade war over a long horizon. By combining structural estimation, general

[1] This literature has expanded rapidly in recent years. Beyond the contributions discussed above, several papers examine the Brexit episode in detail, including Breinlich et al. (2020), Gasiorek and Tamberi (2023), and de Lucio et al. (2024). Others adopt a model-based approach to simulate withdrawals from trade agreements. Examples include Mayer et al. (2019), Campos and Timini (2019), and Felbermayr et al. (2022). Caliendo and Parro (2023) provide a comprehensive overview of both the empirical and model-based literature analyzing the U.S.–China trade war.

[2] For recent contributions, see Campos et al. (2023), Jakubik and Ruta (2023), Fernández-Villaverde et al. (2024), and Gopinath et al. (2025a), among others.

[3] Previous studies that examine Italy's trade and trade openness include Estevadeordal (1997), Federico and Tena (1998), Federico and Vasta (2015), and Timini (2021). The consequences for economic growth are addressed by Coppa (1970), O'Rourke (2000), and Federico and O'Rourke (2001), among others.

equilibrium analysis, and data-driven counterfactuals, the paper provides new evidence on the persistence and aggregate consequences of one of the most important reversals of trade policy during the first wave of globalization.

The remainder of the paper proceeds as follows. Section 2 provides historical background on the Franco-Italian trade war. Section 3 lays out the empirical strategy, data, and counterfactual frameworks. Section 4 documents the bilateral trade effects of the conflict, while Section 5 studies their aggregate implications in general equilibrium. Section 6 discusses the results. Section 7 concludes.

2 Tariffs and trade between Italy and France in the nineteenth century

2.1 Institutional background

Nineteenth-century European trade policy was organized around a dual tariff system. Countries maintained a general tariff schedule with relatively high, non-preferential rates, alongside a preferential (or *conventional*) tariff schedule applied to treaty partners. These arrangements were often governed by Most Favored Nation (MFN) clauses, which extended negotiated tariff reductions to other treaty partners. As a result, access to foreign markets depended heavily on the network of treaties in force. Because conventional tariffs could differ sharply from general tariffs, the lapse of a treaty could imply an immediate and economically meaningful increase in bilateral trade barriers.

Following its unification in 1861, Italy adopted a relatively liberal trade policy and entered into a series of trade agreements. Among them, the 1863 agreement with France was particularly important, establishing preferential tariff treatment across a broad range of goods and helping consolidate one of Italy's most important trading relationships (Calderoni, 1961). This institutional framework remained in place, with periodic renegotiations, until the late 1880s. Its eventual breakdown therefore represented not a marginal policy adjustment, but the abrupt collapse of a long-standing preferential trading arrangement.

2.2 The trade war of 1888

In 1887, Italy introduced a more restrictive general tariff schedule and invoked the termination clause of its trade agreement with France in an attempt to renegotiate its terms (Coppa, 1970). These negotiations failed amid growing political hostility following Italy's entry into the Triple Alliance with Germany and Austria-Hungary. Contemporary accounts suggest that French policymakers viewed trade policy as closely linked to these geopolitical developments.[4]

In early 1888, both countries imposed sharply higher tariffs on each other's imports. Italy raised tariffs on French goods by roughly 50% on average, while France imposed especially large increases on several major Italian exports (Bassani, 1932). For some key products, the changes were dramatic: tariffs on wine rose from about 4% to roughly 48% on an ad valorem equivalent basis, while duties on citrus, olive oil, and livestock increased severalfold (Becuwe and Blancheton, 2014).[5] These measures took effect in March 1888 and generated a discrete and economically meaningful increase in bilateral trade barriers.

The trade war formally lasted until 1898, when a new agreement restored preferential tariffs. However, the post-1898 settlement did not fully return bilateral trade policy to its pre-trade war state. Important Italian exports such as wine and silk—which together represented more than half of Italy's exports to France before the trade war—remained excluded from preferential treatment, implying that the effective normalization of trade relations was incomplete (Conybeare, 1985; James and O'Rourke, 2013). This distinction between the formal end of the conflict and the incomplete restoration of preferential access is important for interpreting the persistence of the trade effects documented below.

2.3 Evolution of trade flows

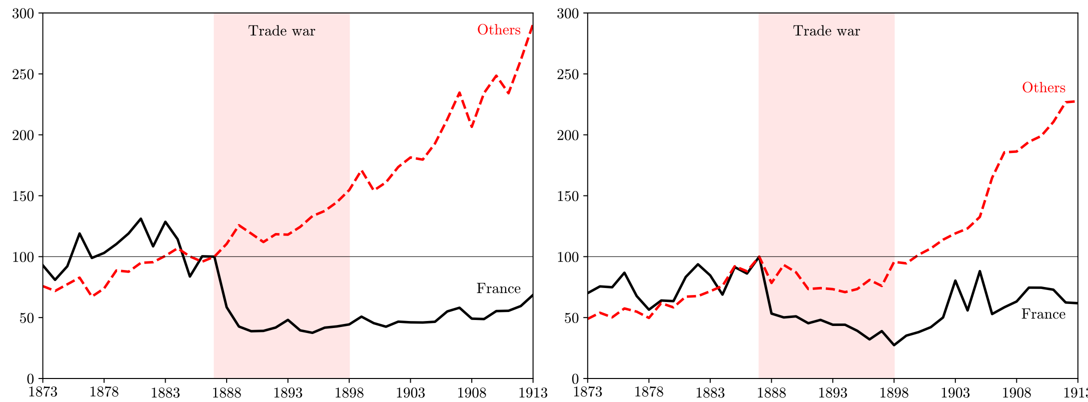
Figure 1 plots the evolution of Italy's trade with France before, during, and after the trade war. The figure shows a marked and persistent decline in bilateral trade following the introduction of punitive tariffs in 1888.[6]

Italy's exports to France fell by more than 50% and remained well below their pre-trade war level throughout the conflict, with only a gradual and incomplete recovery after 1898. Imports from France also declined sharply and failed to return to their pre-war level. These patterns are suggestive of a large and persistent bilateral disruption, but they do not by themselves identify the causal effect of the trade war.

[4]As reported by Calderoni (1961), this sentiment is captured by a statement by senator Teisserenc de Bort, a leading French trade negotiator, who said: "As long as you are in the Triple [Alliance], an agreement [i.e., a trade agreement] between Italy and France will not be possible".

[5]Table D.1 in the appendix reports the pre-conflict preferential tariff schedule and the higher tariffs imposed by France in 1888 for a set of major Italian export goods. The table is intended to document the magnitude and composition of the policy shock rather than to provide the direct inputs for the empirical analysis.

[6]See Federico et al. (2012) and Timini (2021) for related analyses of Italy's trade flows during this period.



(a) Italy's exports

(b) Italy's imports

Figure 1: Italy's exports and imports

Note: The figure shows trade normalized so that the 1887 value equals 100. Black solid lines: Italy–France bilateral flows. Red dashed lines: Italy's flows with all other partners. Left: exports; right: imports. Data: Nominal trade data from TRADHIST v4 (Fouquin and Hugot, 2016) adjusted by the purchasing power of the British pound (O'Donoghue et al., 2004, Table 3). The shaded area indicates the trade war period.

To place these dynamics in context, the figure also reports Italy's trade with all other partners. While exports to France collapsed, exports to other destinations continued to expand after 1888, indicating that the bilateral decline was not simply the reflection of a generalized contraction in Italian exports. Imports from other countries display a more temporary decline followed by recovery, in contrast with the prolonged weakness of imports from France.

These patterns are consistent with a reallocation of trade toward third markets following the disruption of Italy–France trade. But they do not indicate whether this reallocation was sufficient to compensate for the bilateral loss in aggregate. Answering that question requires a counterfactual for the evolution of Italy's total trade in the absence of the conflict, rather than a simple comparison between France and other destinations.

For this reason, the remainder of the paper relies on structural gravity and synthetic control methods to construct counterfactual trade flows. These approaches allow us to estimate the impact of the trade war while accounting for concurrent changes in the global trading environment and to quantify its effects on both bilateral and aggregate trade.

3 Empirical strategy and data sources

3.1 Gravity specification

We estimate the effect of the trade war on bilateral trade flows using a structural gravity framework. The data track trade between country pairs over time, allowing us to compare the evolution of Italy–France trade to that of other country pairs before, during, and after the conflict. Identification comes from differential changes in bilateral trade between Italy and France relative to other pairs, conditional on a rich set of fixed effects that absorb country-specific shocks and common changes in the international trading environment, as well as time-invariant heterogeneity of country pairs.

Our empirical specification is:

$$E[X_{ijt} \mid \cdot] = \exp(\beta_0 + \beta_{\text{TW}}\text{Trade War}_{ijt} + \beta_{\text{PTW}}\text{Post Trade War}_{ijt} + \boldsymbol{\beta}_Z' \boldsymbol{Z}_{ijt} + \gamma_t b_{ij} + \phi_{it} + \psi_{jt} + \omega_{ij}). \tag{1}$$

Here, X_{ijt} denotes gross trade from exporter i to importer j in year t. The specification includes exporter–time and importer–time fixed effects, ϕ_{it} and ψ_{jt}, which absorb all country-specific shocks and non-discriminatory changes in trade costs, and exporter–importer fixed effects, ω_{ij}, which absorb time-invariant bilateral determinants of trade such as distance, common language, and historical ties. Conditional on these controls, the coefficients of interest capture changes in Italy–France trade relative to other country pairs over time.

The main variables of interest are Trade War$_{ijt}$ and Post Trade War$_{ijt}$. The variable Trade War$_{ijt}$ equals one for trade flows between Italy and France during the trade war (1888–1898), and zero otherwise. The variable Post Trade War$_{ijt}$ equals one for the same country pair in the post-conflict period (1899–1913), and zero otherwise. These indicators allow us to distinguish between the contemporaneous effect of the conflict and its persistence after the restoration of formal trade relations. In particular, the coefficient on Post Trade War$_{ijt}$ captures whether bilateral trade remained below its pre-conflict level even after the formal end of the dispute.

The vector $\boldsymbol{Z}_{ijt}$ includes time-varying bilateral controls. In our baseline specification, we control for whether both countries are on the gold standard and for the presence of a bilateral trade agreement.

We also allow for time variation in the relative costs of international versus domestic trade by interacting a border indicator, b_{ij}, with year effects. The indicator equals one for international trade flows and zero for domestic trade. The resulting coefficients, γ_t, capture changes over time in the average level of international trade frictions and are commonly interpreted as reflecting the evolution of globalization (Bergstrand et al., 2015).

The exporter–time and importer–time fixed effects are particularly important in this setting because they absorb changes in country size, expenditure, and non-discriminatory trade policies. In particular, they absorb reforms to the general tariff schedules of Italy and France around the time of the trade war, ensuring that identification is driven by bilateral rather than unilateral changes in trade barriers. More broadly, these fixed effects provide a standard way of accounting for multilateral resistance (Anderson and van Wincoop, 2003).

We estimate Equation (1) using Poisson Pseudo-Maximum Likelihood (PPML) (Santos Silva and Tenreyro, 2006), which is standard in gravity settings with heteroskedasticity and zero trade flows. Standard errors are clustered at the level of directional country pairs to allow for serial correlation in bilateral trade relationships over time. The sample covers the period 1870–1913 and includes all countries for which the required trade data are available.

As a complementary specification, we also estimate an event-study version of Equation (1) that replaces the period indicators with year-specific interactions for Italy–France trade in order to trace the dynamic effects of the conflict. This specification allows the effect of the trade war to vary flexibly over time and provides a direct visualization of both the onset and persistence of the bilateral trade disruption. Importantly, the event-study design also provides a useful check on the absence of differential pre-trends prior to 1888.

3.2 A quantitative trade model

We use a quantitative trade model to translate the estimated bilateral effects of the trade war into general equilibrium implications for aggregate trade and welfare. Specifically, we interpret the coefficients from the gravity equation as changes in bilateral trade costs and embed them in a multi-country framework to compute the implied adjustment of trade flows across all country pairs. This allows us to quantify how the bilateral disruption between Italy and France propagated through the broader trading system, including the extent of trade diversion toward third countries.

We employ a standard multi-country trade model that yields a gravity structure for bilateral trade flows.

Each country produces a distinct good and trades subject to iceberg trade costs, so that bilateral trade depends on relative trade costs, prices, and expenditure. In this class of models, counterfactual changes in trade flows can be computed using "hat algebra" methods (Dekle et al., 2008). Simulation results rely on a small set of sufficient statistics, as emphasized by the "universal gravity" framework (Allen et al., 2020): observed bilateral trade flows in a baseline equilibrium, the change in bilateral trade costs, and a limited number of structural parameters. In particular, the trade elasticity governs the responsiveness of trade flows to changes in trade barriers, while the supply elasticity determines how production responds to changes in relative prices.

To connect the empirical estimates to the model, we interpret the coefficients on the trade war indicators as changes in bilateral trade costs. In the structural gravity framework, bilateral trade flows depend on trade costs raised to the power of the trade elasticity. The estimated coefficients can therefore be mapped into proportional changes in bilateral trade costs, where larger negative coefficients imply larger increases in trade barriers. This interpretation is intentionally broad: the estimated trade-cost changes may reflect not only tariffs, but also other conflict-related disruptions to bilateral trade.

We use this mapping to construct a counterfactual scenario in which the Franco-Italian trade war did not occur. Specifically, we remove the estimated trade war and post-trade war components from bilateral trade costs between Italy and France, while leaving all other bilateral trade costs unchanged. The resulting counterfactual captures how trade flows would have evolved had bilateral trade barriers between the two countries not increased in 1888 and not remained elevated thereafter.

To implement the counterfactual, we combine observed bilateral trade flows in a baseline year with the implied changes in bilateral trade costs and calibrated values for the model's structural elasticities. We next discuss our choice of the two structural elasticities. Additional details on the model structure, calibration, and solution method are provided in Appendix A.

Calibration of the trade elasticity. We set the trade elasticity to 5 in the baseline calibration. This value is consistent with the standard benchmark used in the structural gravity literature and closely matches the preferred estimate reported by Head and Mayer (2014). It also lies comfortably within the range of values commonly used in quantitative trade counterfactuals.[7]

At the same time, there is substantial uncertainty about the appropriate value in a historical setting.

[7]Simonovska and Waugh (2014) report an estimate of 4.14. Different empirical approaches recover somewhat different elasticity concepts. For example, Bajzík et al. (2020) report lower central estimates in a meta-analysis of Armington elasticities, whereas gravity-based estimates tend to imply somewhat larger trade elasticities.

Most available estimates are based on modern data, whereas substitution patterns may have differed during the first wave of globalization. In particular, traded goods were likely less differentiated in the late nineteenth century, which could imply stronger substitution across origins and therefore a higher trade elasticity. As a case in point, Donaldson (2018) estimates an average trade elasticity of 7.8 for trade of agricultural commodities within India over the period 1870–1930. Consistent with the interpretation that the trade elasticity could have been higher in the late nineteenth century, Jacks et al. (2010) adopt a value of 10 in their analysis of trade costs over the period 1870–1913. Conversely, Timini (2023) estimates an elasticity closer to 5 for tariff changes over the period 1855–1875 while more recent evidence suggests that the trade elasticity may be smaller over shorter and medium-run horizons than is often assumed in static trade models. Using tariff variation in modern data, Boehm et al. (2023) estimate trade elasticities that are markedly lower than conventional long-run benchmarks and that increase only gradually over time.

We therefore view a value of 5 as a moderate and transparent baseline. It avoids building the quantitative results either on the assumption of very high substitutability, as in some historical calibrations, or on very low short-run responsiveness. As discussed below, we assess the sensitivity of the results to both higher and lower values of the trade elasticity, so that the conclusions do not hinge on a single parameter choice.

Calibration of the supply elasticity. We set the supply elasticity to 1 in the baseline calibration.[8] In the quantitative trade framework underlying our counterfactual exercise, this parameter governs the responsiveness of production to changes in relative prices and therefore shapes the extent to which countries expand or contract output in response to bilateral trade-cost shocks. A higher supply elasticity implies that production adjusts more strongly when trade barriers change, amplifying the general equilibrium reallocation of trade and expenditure across countries.

We view a value of 1 as a reasonable benchmark for the late nineteenth-century economy. On the one hand, production during the first wave of globalization was already characterized by meaningful input linkages across sectors and countries (Meissner and Tang, 2018; Becuwe et al., 2018, 2021). On the other hand, production structures remained less vertically fragmented than in the modern economy, and

[8] In the benchmark Armington-style environment with Cobb–Douglas production and intermediate inputs, the supply elasticity can be written as a function of the production-side cost shares. In that special case, a value of 1 corresponds to an intermediate-input share of one half in total production costs. We view this relationship as a useful economic interpretation rather than as a direct empirical calibration device, since it depends on the specific production structure assumed in the model.

adjustment in labor and capital allocation was likely slower and more incomplete than in contemporary settings. These considerations suggest that a moderate positive supply elasticity is more plausible than either a near-zero value, which would imply highly rigid production, or a very high value, which would imply almost frictionless expansion of output in response to relative-price changes.

This choice is also consistent with the broader quantitative trade literature, which offers less consensus on the appropriate value of the supply elasticity than on the trade elasticity. In canonical general equilibrium trade models, Alvarez and Lucas (2007) effectively adopt a value of 1, while the Eaton–Kortum environment implies a substantially higher elasticity of approximately 3.76, as discussed by Allen et al. (2020). More recent applied implementations of universal-gravity counterfactuals have used values such as 1.24, calibrated from modern data; see Campos et al. (2023). Relative to these alternatives, a baseline value of 1 is intentionally conservative and transparent. It avoids tying the quantitative results too closely either to modern estimates of production flexibility, which may not map well to our historical setting, or to higher calibrations that imply very strong output adjustment.

To ensure that the quantitative conclusions are not driven by this calibration choice, we assess the robustness of the results to alternative values of the supply elasticity.[9]

3.3 Synthetic controls

To complement the gravity-based estimates, we apply a synthetic control method (SCM) (Abadie and Gardeazabal, 2003; Abadie et al., 2010, 2015) to construct a data-driven counterfactual for the evolution of bilateral trade between Italy and France. This approach provides an independent assessment of the effects of the trade war that does not rely on the parametric structure of the gravity model. By comparing observed trade shares for the Italy–France relationship to those of a synthetic control, we can assess whether the sharp decline and persistence observed after 1888 are consistent with a counterfactual in which the trade war did not occur.

A key feature of our design is that the unit of analysis is a *directed country pair*, rather than a country. In other words, the treated units are bilateral trade relationships such as Italy's exports to France and Italy's imports from France, and the donor pool consists of other directed country pairs not involving

[9] There is substantial uncertainty around the appropriate value in our historical application. If production in the late nineteenth century relied less heavily on intermediate linkages than in modern data, the relevant supply elasticity may have been lower than values calibrated from contemporary production structures. Conversely, if sectoral production was sufficiently responsive to international relative-price changes despite slower factor reallocation, somewhat higher elasticities may also be plausible.

either Italy or France. This is useful in a historical setting because it greatly expands the number of untreated units available for comparison relative to country-level analyses. More broadly, bilateral trade data are particularly well suited to SCM in economic history: they generate a comparatively large donor pool, are typically based on directly recorded customs data rather than imputed macroeconomic aggregates.

We implement the SCM by constructing a weighted combination of unaffected directed country pairs that best reproduces the pre-1888 evolution of Italy's bilateral trade shares with France. The synthetic control is chosen to best match the full pre-trade-war path of the relevant trade share over 1873–1886. We focus on trade shares rather than trade levels, which helps control for changes in overall trade openness and isolates the importance of France in Italy's trade. Deviations between actual and synthetic trade shares after 1888 are then interpreted as the effect of the trade war. To assess the significance of these effects, we conduct placebo tests that compare the estimated treatment effect to the distribution obtained when applying the same procedure to untreated country pairs. Details on the construction of the donor pool, optimization procedure, and placebo tests are provided in Appendix B.

The validity of the SCM relies on two key assumptions. First, the trade war must be plausibly exogenous to prior trends in bilateral trade. Historical evidence supports this view: Italian policymakers expected that invoking the termination clause of the agreement would lead to more favorable terms, suggesting that the precise timing and severity of the breakdown in negotiations may not have been fully anticipated. Second, the donor pool should not be systematically affected by the trade war. Although spillovers to third-country pairs cannot be entirely ruled out, our design minimizes their likely importance.

To limit spillovers, we exclude all country pairs involving Italy or France from the donor pool and rely only on bilateral relationships that are less likely to be directly affected by the conflict. We also use trade shares rather than levels, which helps absorb common changes in aggregate trade volumes that may affect many countries simultaneously. In practice, the country pairs receiving positive weights are predominantly extra-European, further reducing the likelihood that the synthetic control is contaminated by spillovers from the Franco-Italian conflict. Taken together, these features make SCM a useful and informative complement to the gravity-based analysis.

3.4 Data sources and definitions

Our empirical analysis is based on an annual panel of bilateral trade flows covering the late nineteenth and early twentieth centuries. The main source is the TRADHIST database (version 4) compiled by Fouquin and Hugot (2016), which provides harmonized historical trade data based on a wide range of primary and secondary sources, including national statistical publications and existing datasets such as RICardo (Dedinger and Girard, 2017). Trade flows are reported in nominal terms and expressed in British pound sterling. This dataset forms the basis of both the gravity estimation and the synthetic control analysis.

For the gravity estimations and general equilibrium counterfactuals, we use annual bilateral trade flows over the period 1870–1913. The resulting gravity sample contains 35 countries and close to 29,000 exporter–importer–year observations, depending on the specification. In some specifications, we also incorporate domestic trade flows, which improve the identification of trade costs by anchoring international trade relative to internal trade (Yotov, 2022). Because historical statistics do not report domestic trade directly, we approximate it as the difference between total production and exports. Since consistent historical data on gross output are not available for a sufficiently broad set of countries and years, we proxy production with nominal GDP and compute domestic trade as GDP minus total exports. Although GDP measures value added rather than gross output, this approximation is standard in historical applications and its impact is mitigated here by the inclusion of exporter-time and importer-time fixed effects (Campos et al., 2021).

The trade war is coded as lasting from 1888 to 1898, consistent with the historical discussion in Section 2 and with Irwin (1993). We define the post-war period as 1899–1913. Additional bilateral controls used in the gravity analysis include indicators for whether both countries are on the gold standard and whether a bilateral trade agreement is in force. These variables are drawn from Officer (2020) and the Trade Agreements Database (Pahre, 2007), respectively.

For the synthetic control analysis, we focus on Italy's bilateral trade shares with France rather than trade levels. The analysis is conducted over the period 1873–1913 so that both the treated unit and the donor pool are defined on a consistent country basis throughout the pre-treatment period. We start the sample in 1873 so as to use pairs involving Germany in the control group.

Export shares are defined as bilateral exports relative to Italy's total exports, and import shares as bilateral imports relative to Italy's total imports. Using shares rather than levels abstracts from changes in Italy's overall trade openness and isolates the relative importance of France as a trading partner over time. These variables are constructed from the same underlying TRADHIST data used in the gravity analysis.

The donor pool for the synthetic control consists of directed bilateral country pairs that do not involve Italy or France. We further restrict the sample to country pairs with complete data over the relevant period and to countries with at least five trading partners on average. After applying these criteria, the donor pool contains 272 directed country pairs. These restrictions are designed to ensure that the synthetic control is constructed from donor units with sufficiently stable and informative trade series over the pre-treatment period.

4 Estimating the bilateral effects of the trade war

4.1 Main effects and persistence

Table 1 reports the baseline gravity estimates of the effect of the trade war on bilateral trade between Italy and France. The estimated effects are consistently large, negative, and highly persistent across specifications. We focus on Column 6 as our benchmark specification because it is estimated by PPML, includes domestic trade flows, allows for time variation in the border effect, and incorporates the full set of exporter-time, importer-time, and country-pair fixed effects. As such, it provides the closest empirical implementation of the structural gravity framework described in Section 3.

The estimates imply that the trade war caused a sharp and persistent contraction in bilateral trade. The implied percentage effects are computed as $100 \times (\exp(\beta) - 1)$. In the preferred specification, the coefficient on the trade-war indicator is -0.861, implying that bilateral trade between Italy and France was about 58% lower during the conflict (1888–1898) than it would have been absent the trade war. The coefficient on the post-trade-war indicator is -0.852, implying that bilateral trade remained about 57% below its counterfactual level during 1899–1913. The two coefficients are statistically indistinguishable, indicating that the disruption to bilateral trade persisted well beyond the formal end of the conflict.

This persistence is consistent with the historical record. Although a new trade agreement was signed in 1898, the normalization of bilateral trade policy remained incomplete. In particular, some major Italian

Table 1: Baseline gravity estimates of the trade war

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Trade war	-0.791***	-0.832***	-0.845***	-0.837***	-0.896***	-0.861***
	(0.303)	(0.294)	(0.296)	(0.156)	(0.108)	(0.110)
Post trade war	-0.706**	-0.730**	-0.752***	-0.953***	-0.854***	-0.852***
	(0.297)	(0.286)	(0.289)	(0.157)	(0.060)	(0.080)
Gold standard	0.212**	0.276***	0.228***	0.017	0.074*	0.060
	(0.095)	(0.087)	(0.080)	(0.071)	(0.041)	(0.037)
Trade agreement	-0.099	-0.103	-0.112*	-0.025	0.011	0.009
	(0.065)	(0.065)	(0.065)	(0.042)	(0.047)	(0.047)
Observations	26,709	27,977	27,977	27,914	29,177	29,177
Estimation method	OLS	OLS	OLS	PPML	PPML	PPML
MTRs and pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Domestic trade	No	Yes	Yes	No	Yes	Yes
Time-varying border	No	No	Yes	No	No	Yes
Coefficient equality (p-value)	0.595	0.505	0.542	0.199	0.573	0.905

Note: The table reports estimates from the gravity specification in Equation (1). The unit of observation is an exporter–importer–year triplet. Columns 1–3 report OLS estimates with the natural logarithm of trade as the dependent variable. Columns 4–6 report PPML estimates with trade levels as the dependent variable. Columns 1 and 4 exclude domestic trade and omit the time-varying border effect. Columns 2 and 5 include domestic trade but omit the time-varying border effect. Columns 3 and 6 include both domestic trade and border-year interactions. All specifications include exporter-time, importer-time, and country-pair fixed effects. Standard errors are clustered by directed country pair. The last row reports the p-value for the null hypothesis that the coefficients on the trade-war and post-trade-war indicators are equal.

exports—most notably wine and silk—continued to face relatively unfavorable treatment in the French market. For example, tariffs on wine declined after the peak of the conflict but remained well above pre-war levels and above those faced by competing exporters such as Switzerland and Spain. These continued barriers provide a natural explanation for why bilateral trade failed to recover after 1898.

At the same time, the persistence of the estimated effects may also reflect mechanisms beyond formal tariff policy. A prolonged trade war may weaken established commercial relationships, alter patterns of specialization and distribution, or induce substitution toward alternative suppliers that is only partially reversible. The results therefore suggest that the trade war generated not only a contemporaneous disruption in bilateral trade, but also longer-lasting changes in trading relationships.

4.2 Dynamic effects and persistence

The baseline specification in Equation (1) summarizes the effects of the Franco–Italian trade war using two period indicators: one for the years of the conflict and one for the post-1898 period. While this provides a parsimonious estimate of the average effect during and after the trade war, it masks the year-by-year dynamics of adjustment. To examine these dynamics more directly, we estimate an event-study version of the gravity equation that replaces the two period indicators with a full set of year-specific interactions for trade between Italy and France, omitting 1887 as the reference year. This specification allows us to assess whether bilateral trade was already evolving differentially before the onset of the conflict, how sharply trade responded in 1888, and whether trade recovered after the 1898 agreement.

Figure 2 reports the resulting coefficients. Prior to 1888, the estimates fluctuate around zero and do not display a clear or sustained pre-trend. Although a few individual years deviate from zero, these deviations are small relative to the discrete downward shift observed in coefficients at the start of the trade war. This pre-war pattern does not suggest that Italy–France trade was already on a persistent downward trajectory before the conflict. By contrast, the onset of the trade war is associated with a clear and immediate break: the coefficient turns sharply negative in 1888 and remains strongly negative thereafter.

The figure also makes the persistence of the effects particularly transparent. Most of the decline occurs early in the conflict, and by the end of the trade-war period the estimated effect is already close to the average level observed thereafter. Following the 1898 agreement, there is no evidence of meaningful

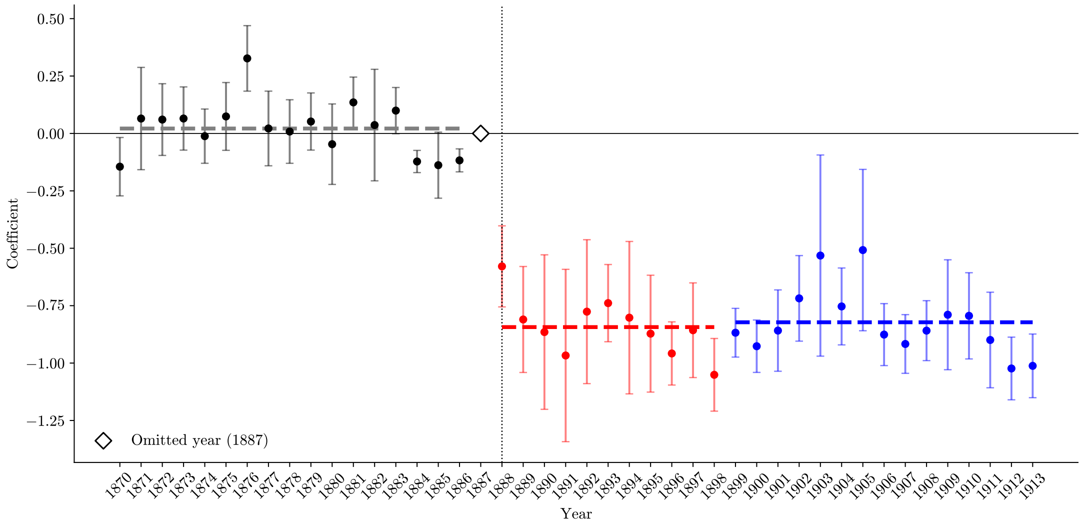


Figure 2: Dynamic effects of the Franco–Italian trade war on bilateral trade

Note: The figure reports year-specific coefficients from an event-study version of the gravity equation in Equation (1), estimated by PPML. The omitted year is 1887. Each point estimate measures the change in bilateral trade between Italy and France relative to other country pairs in the corresponding year, conditional on exporter-time, importer-time, and country-pair fixed effects, as well as the full set of controls included in the benchmark specification. Vertical bars denote 95% confidence intervals based on standard errors clustered by directed country pair. Black markers indicate pre-trade-war years, red markers indicate the trade-war period (1888–1898), and blue markers indicate the post-trade-war period (1899–1913). The hollow diamond marks the omitted reference year. The horizontal dashed lines show the average estimated coefficient within each of the three periods.

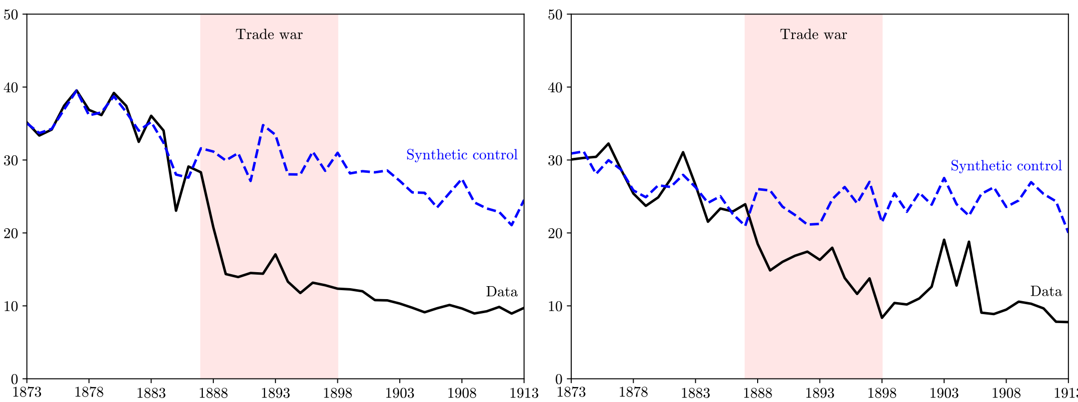
recovery toward the pre-conflict path. If anything, the final years of the sample remain at least as negative as the average post-war effect. This pattern is fully consistent with the baseline estimates in Table 1, but shows more clearly that the persistence is not an artifact of collapsing the post-1888 period into broad intervals.

Taken together, the event-study estimates strengthen the interpretation of the trade war as a discrete and highly persistent bilateral trade shock. They also reinforce the view that the weakness of Italy–France trade after 1898 was not simply the continuation of a pre-existing trend, but rather the long-lasting consequence of the disruption that began in 1888.

4.3 Evidence from synthetic controls

We complement the gravity estimates with a synthetic control analysis that provides an alternative, less parametric counterfactual for the evolution of Italy's bilateral trade with France. We construct synthetic controls separately for Italy's export share to France and import share from France, using weighted combinations of untreated directed country pairs drawn from a donor pool that excludes all flows involving Italy or France. The resulting synthetic units are formed from a relatively small number of donor pairs, most of which are extra-European; the full donor weights are reported in Appendix B.

Figure 3 compares the observed trade shares with their synthetic counterparts. For exports, Italy's share to France drops sharply after 1888—from roughly 30% before the conflict to about 15% within two years—while the synthetic series shows no comparable break. For imports, the observed share also declines substantially, albeit more gradually, whereas the synthetic series remains broadly stable around its pre-war level. In both cases, the divergence between the observed and synthetic series emerges at the onset of the trade war and persists throughout the sample period.



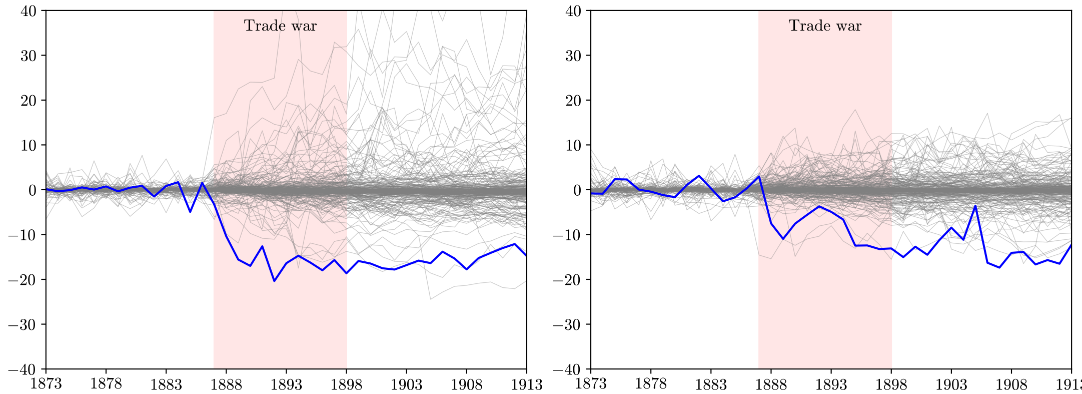
(a) Italy's export share to France (b) Italy's import share from France

Figure 3: Bilateral export and import shares for Italy with France and their synthetic controls

Note: The figures compare Italy's observed export share to France and import share from France with their synthetic controls over the period 1873–1913.

Figure 4 reports the gap between the observed and synthetic series together with the distribution of placebo estimates. In the pre-war period, the deviations are centered close to zero, indicating a good fit prior to treatment. After 1888, the gaps become large and persistently negative for both exports and imports, with no meaningful convergence back toward zero over the remainder of the sample. This pattern reinforces the main conclusion from the gravity analysis: the trade war produced a sharp and durable decline in Italy's bilateral trade with France. Relative to the placebo estimates, the post-1888 divergence is economically large and sustained over time. Appendix B provides additional diagnostics showing that permutation-based inference in this setting is affected by heterogeneity in outcome scale and pre-treatment variation across donor units.

Robustness. The SCM results are robust to changes in donor composition and to alternative outcome definitions. First, the results are not driven by any single heavily weighted donor pair. Re-estimating the



(a) Italy's export share to France (b) Italy's import share from France

Figure 4: Deviations of historical trade flows from the synthetic control and permutations.

Note: The figures show the deviation in percentage points between the observed trade share and its synthetic counterpart. The thin gray lines report placebo estimates for donor pairs whose pre-treatment mean squared prediction error (MSPE) is no greater than five times that of the treated unit. The shaded area indicates the years of the trade war (1888–1898).

synthetic control after sequentially excluding the most heavily weighted donor units produces deviation paths that remain very close to the baseline estimates for both export and import shares.[10] Second, using bilateral trade levels instead of trade shares yields qualitatively similar results: the estimated effects remain large and persistent, with a sharp break at the onset of the trade war and no subsequent convergence.[11] These exercises indicate that the SCM findings are not driven by a single influential donor pair or by the normalization implicit in the use of trade shares.

5 From bilateral disruption to aggregate effects

We next use the estimated bilateral effects of the trade war to quantify its aggregate consequences. Specifically, we embed the gravity estimates in a multi-country general equilibrium trade model and simulate a counterfactual path in which bilateral trade costs between Italy and France do not rise in 1888 and do not remain elevated thereafter. This exercise allows us to move from reduced-form evidence on bilateral trade flows to a structural assessment of how the conflict affected aggregate trade, trade diversion, and welfare.

We implement the counterfactual using the benchmark gravity estimates reported in Table 1, Column 6.

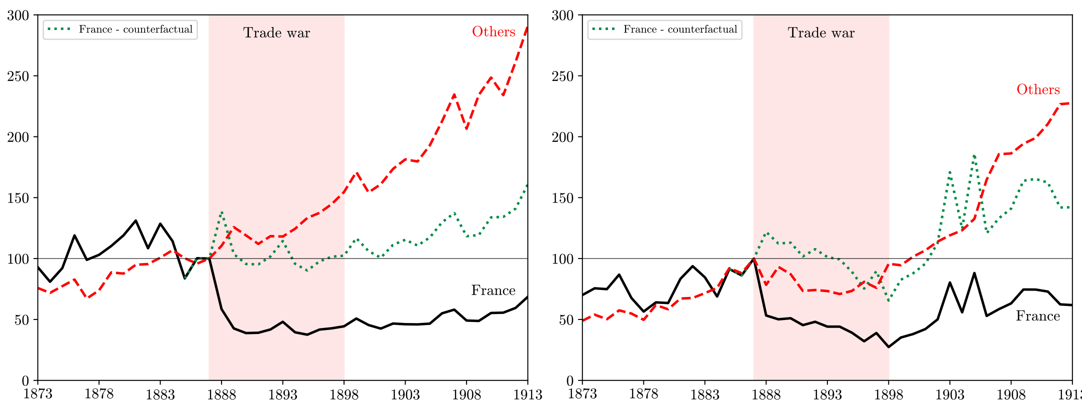
[10]See Figure B.3 in the appendix.
[11]See Figure B.4 in the appendix.

For each year from 1888 to 1913, we remove the estimated trade-war component from Italy–France bilateral trade costs, i.e., we set

$$\hat{\tau}_{ijt} = \begin{cases} \exp\left(\hat{\beta}_{\mathrm{TW}}/\theta\right), & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1888 \leq t \leq 1898, \\ \exp\left(\hat{\beta}_{\mathrm{PTW}}/\theta\right), & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1898 < t \leq 1913, \\ 1, & \text{otherwise.} \end{cases}$$

where $\hat{\tau}_{ijt}$ denotes bilateral trade costs in the counterfactual relative to the baseline and $\theta = 5$ denotes the trade elasticity. We then solve for the resulting general equilibrium, and compare the implied counterfactual outcomes to the observed data.

Bilateral counterfactual. Figure 5 adds the model-implied counterfactual to the historical evolution of Italy's trade. The figure confirms that the collapse in Italy–France trade after 1888 was not simply part of a broader reallocation within Italy's external trade. In the data, bilateral trade with France falls sharply at the onset of the conflict, while trade with other partners continues to expand. In the counterfactual, by contrast, trade with France would have remained much closer to its pre-war path, especially for exports.



(a) Italy's exports (b) Italy's imports

Figure 5: Simulation results: Italy's exports and imports

Note: The figure shows trade normalized so that the 1887 value equals 100. Black solid lines: Italy–France bilateral flows. Red dashed lines: Italy's flows with all other partners. Left: exports; right: imports. Data: Nominal trade data from TRADHIST v4 (Fouquin and Hugot, 2016) adjusted by the purchasing power of the British pound (O'Donoghue et al., 2004, Table 3). Green dotted lines: general equilibrium counterfactual bilateral exports (left) and counterfactual bilateral imports (right). Simulations are computed separately for each year 1888–1913.

This comparison is informative because trade with third countries is not, by itself, a valid counterfactual for what would have happened to Italy–France trade absent the conflict. The counterfactual series show that, even without the trade war, bilateral trade with France would not have grown as rapidly as trade with all other partners combined. This implies that the post-1888 expansion of Italy's trade with alternative markets partly reflects broader global developments rather than pure substitution away from France. The gap between observed and counterfactual bilateral trade opens abruptly in 1888 and remains large throughout the post-1898 period, indicating that the bilateral relationship did not return to its pre-conflict trajectory even after the new agreement.

Table 2: General equilibrium effects of the Franco–Italian trade war

	Italy		France	
	1888–1898	1899–1913	1888–1898	1899–1913
Bilateral trade loss (%)	-57.0	-56.4	-57.0	-56.4
Trade diversion offset (%)	5.0	8.4	3.5	2.4
Total trade loss (%)	-16.3	-12.2	-5.6	-5.6
Welfare loss (%)	-0.8	-0.8	-0.3	-0.3

Note: The table reports general-equilibrium effects of the Franco–Italian trade war during the trade-war period (1888–1898) and the post-trade-war period (1899–1913), relative to a no-trade-war counterfactual. Bilateral trade is defined as total trade between Italy and France, that is, exports plus imports in both directions. Total trade for each country is defined as total exports plus total imports. The entries for bilateral trade loss and total trade loss are computed from trade flows first summed over all years in the relevant period and then expressed as percentage deviations from the corresponding counterfactual totals. Trade diversion offset is the share of lost bilateral trade with the partner country that is compensated by increased trade with third countries, computed from period totals. Welfare loss is the simple average of the annual percentage welfare deviations relative to the no-trade-war counterfactual within each period.

Table 2 summarizes the broader implications of the general equilibrium simulations. The bilateral trade loss reported in the table provides the natural benchmark for interpreting the general equilibrium results. By construction, it closely reflects the estimated bilateral disruption disciplined by the gravity model.[12] Relative to that benchmark, two substantive findings emerge.

First, trade diversion toward third markets is quantitatively limited. For Italy, only about 5.0% of the lost bilateral trade with France is offset by increased trade with third countries during the trade-war period, rising to 8.4% in the post-trade-war years. For France, the corresponding figures are even smaller. Thus, the model implies some reallocation across partners, but the magnitude of that reallocation is small relative to the bilateral collapse. In other words, most of the lost Italy–France trade was not

[12] The small discrepancy in the bilateral trade loss between the empirical estimate and the model is due to the general equilibrium effects present in the latter. The empirical estimate using the structural gravity equation should be interpreted as a partial equilibrium effect in which all country-specific factors, such as multilateral resistances are held fixed across the baseline and the counterfactual. The general equilibrium model solves for the change in these general equilibrium objects and yields the bilateral trade loss once these changes are taken into account.

replaced elsewhere.

Second, because trade diversion is incomplete, the bilateral rupture translates into sizable aggregate losses. Italy's total trade is 16.3% below its no-trade-war counterfactual during 1888–1898 and remains 12.2% lower during 1899–1913. France also experiences aggregate losses, though substantially smaller, at about 5.6% in both periods. These results indicate that the trade war did not simply reshuffle trade across destinations, but instead reduced overall trade integration for a prolonged period.

The aggregate trade losses also imply persistent welfare costs. Measured as the compensating variation in per-capita real consumption relative to the no-trade-war counterfactual, welfare losses average about 0.8% for Italy and 0.3% for France in both periods. While these magnitudes are smaller than the trade-flow effects, they indicate that the trade war had economically meaningful real consequences beyond bilateral trade alone. The asymmetry between the two countries is consistent with Italy's greater pre-war dependence on the French market.

Robustness and timing of adjustment. The trade-flow results are highly robust to alternative parameterizations of the model. Repeating the simulations under different values of the trade elasticity and the supply elasticity yields nearly identical estimates of the bilateral trade loss, the limited extent of trade diversion, and the reduction in Italy's aggregate trade. By contrast, the welfare magnitudes are more sensitive to the assumed elasticities, especially to the trade elasticity. Thus, the central conclusion that the bilateral rupture translated into economically meaningful aggregate trade losses does not depend on the benchmark calibration, even though the precise welfare costs are more model-dependent.

The simulations are also informative about the timing of adjustment. In the baseline, the trade elasticity is held constant over time. As an alternative, we consider a calibration in which the trade elasticity is lower immediately after the onset of the trade war and rises gradually to its baseline value over the following decade, consistent with evidence that the trade elasticity may increase over time as adjustment unfolds (Boehm et al., 2023). Under this specification, the main conclusions are unchanged: the bilateral collapse in Italy–France trade remains large, trade diversion toward third markets is still limited, and aggregate trade losses remain very similar to the baseline. However, the implied welfare losses during the trade-war years are noticeably larger, more than double for Italy in the short run. This suggests that, although trade quantities may eventually have reallocated in broadly similar ways, the short-run welfare costs of the disruption were likely more severe when substitution possibilities were initially more limited. Therefore, the welfare numbers previously reported may be interpreted as a conservative estimate of the short-run costs of the trade war. Appendix C reports the full sensitivity analysis.

Comparison with the SCM counterfactual. The counterfactual series generated by the general equilibrium model align closely with the patterns obtained from the synthetic control analysis. In the appendix, we construct an alternative counterfactual by applying the SCM-implied changes in bilateral trade shares to aggregate trade flows. The resulting series closely track those implied by the general equilibrium model, reinforcing the robustness of the counterfactual analysis.[13]

Taken together, the simulations suggest that the main long-run consequence of the trade war was not simply a redirection of trade across partners, but a persistent reduction in overall trade integration for the parties directly involved. In this sense, a discrete increase in bilateral trade barriers had durable aggregate effects even after formal trade relations were partially restored. The bilateral rupture was partly absorbed through reallocation toward third markets, yet this adjustment remained too limited to offset the aggregate trade and welfare losses generated by the conflict.

6 Discussion

6.1 Interpreting historical evidence in light of contemporary trade fragmentation

The Franco–Italian trade war provides a rare opportunity to study the effects of a sharp increase in trade barriers over an extended horizon. This makes it a useful historical benchmark for interpreting more recent episodes of trade disruption, such as Brexit, the U.S.–China trade war, and the broader rise in geopolitical fragmentation. A growing empirical literature has documented sizable short-run effects of these episodes on trade flows, prices, and welfare (e.g., Amiti et al., 2019; Fajgelbaum et al., 2020; Kren and Lawless, 2024), while recent work has emphasized the role of geopolitical alignment in shaping trade patterns (e.g., Campos et al., 2023; Gopinath et al., 2025a). However, the relatively short post-event horizon in these settings makes it difficult to assess how adjustment unfolds over longer periods. In this respect, the historical evidence presented here provides a longer-run perspective on the consequences of trade fragmentation.

At the same time, important differences between the late nineteenth century and the modern global

[13] See Figure C.3 in the appendix.

economy caution against direct extrapolation. Trade in the period we study was more concentrated in primary goods and relatively homogeneous products, whereas modern trade is characterized by a larger role for differentiated goods, global value chains, and firm-level heterogeneity. Transportation technologies and logistics also differed in important ways. While maritime transport was already relatively well developed, overland transport remained more costly and less integrated than today, potentially limiting the scope for rapid reorientation of trade flows across nearby markets. Modern trade is also embedded in a denser institutional and economic environment, including multilateral agreements and financial linkages that may facilitate or constrain adjustment in ways that differ from the historical setting. These differences imply that the magnitude and channels of adjustment are not directly comparable across periods.

With these caveats in mind, three features of the historical episode are informative for interpreting contemporary evidence. First, the results highlight the importance of persistence. In the Franco–Italian case, the decline in bilateral trade following the introduction of higher tariffs is immediate, but its most striking feature is its durability: trade remains substantially below its pre-conflict level for more than two decades, despite the formal normalization of trade policy after 1898. Importantly, this normalization was incomplete, tariffs on several key Italian exports remained high after 1898, suggesting that the political difficulty of fully unwinding trade barriers can itself be a source of persistence. This suggests that short-run estimates of trade responses may understate the full economic impact of trade disruptions if adjustment unfolds gradually and if trade relationships are costly to rebuild.

Second, the historical evidence indicates that reallocation toward third markets can be a relevant margin of adjustment, but may remain incomplete. In our setting, Italy increases trade with alternative partners following the collapse of trade with France, yet this reorientation does not fully offset the initial disruption, and aggregate trade remains persistently below its counterfactual level. This pattern is consistent with recent evidence documenting rerouting of trade flows in response to trade tensions and geopolitical fragmentation, including the growing role of third countries in mediating trade between blocs (Freund et al., 2024; Gopinath et al., 2025b). At the same time, the historical experience suggests that such reallocation may coexist with sustained aggregate losses rather than fully compensating for the disruption of established bilateral relationships.

Third, the effects of trade disruptions appear to be asymmetric and shaped by pre-existing trade patterns. In the Franco–Italian case, the model implies a substantially larger aggregate impact for Italy than for

France, reflecting Italy's greater dependence on the French market prior to the conflict. This observation resonates with recent work emphasizing that the costs of trade fragmentation depend on countries' positions within global trade networks and their exposure to specific partners. In this sense, the historical episode illustrates how the structure of trade relationships can condition both the magnitude and the persistence of adjustment to rising trade barriers.

Taken together, these considerations suggest that the main contribution of the historical evidence is not to provide a direct quantitative guide to the effects of modern trade wars, but rather to offer a longer-run perspective on the dynamics of adjustment. The Franco–Italian trade war shows that trade disruptions can persist well beyond the initial policy shock, that reallocation across partners may be only partial, and that aggregate outcomes depend critically on the structure of pre-existing trade relationships. These features are consistent with, and help contextualize, the patterns documented in the recent empirical literature, while underscoring the importance of longer horizons when assessing the consequences of trade fragmentation.

6.2 Reassessing the Franco–Italian trade war

The results also speak to the historical interpretation of the Franco–Italian trade war itself. Existing accounts have emphasized the political and diplomatic origins of the conflict, as well as its role in the broader protectionist turn of the late nineteenth century (e.g., Coppa, 1970; Calderoni, 1961; Federico and O'Rourke, 2001). Our findings complement this literature by showing that the episode was not only politically significant, but also economically consequential in a persistent and quantitatively meaningful way.

A first implication is that the trade war should not be interpreted as a short-lived commercial disruption with limited long-run relevance. The estimates indicate that the conflict caused a large collapse in bilateral trade between Italy and France and that this disruption persisted well beyond the formal end of the trade war in 1898. In this sense, the episode is better understood not as a short-lived disruption, but as a turning point that permanently weakened one of Italy's most important commercial relationships during the first wave of globalization.

A second implication concerns the interpretation of the 1898 agreement. In formal terms, the agreement marked the end of the trade war and the restoration of preferential tariff treatment. However, the persistence of depressed bilateral trade after 1898 suggests that the normalization of economic relations was incomplete. This interpretation is consistent with the continued exclusion or unfavorable treatment of several major Italian exports, including wine and silk, but it also suggests that the conflict may have had effects extending beyond the tariff schedule itself. Once disrupted, commercial relationships may not have been easily rebuilt, even after the most acute phase of the conflict had passed.

Finally, the results clarify the asymmetric economic importance of the conflict. The trade war imposed larger aggregate costs on Italy than on France, reflecting the fact that Italy was more dependent on the French market before 1888. The asymmetry makes clear that the conflict did not affect the two sides equally; instead, its economic burden was largely determined by the structure of pre-existing trade relationships. More broadly, the findings suggest that episodes such as the Franco–Italian trade war formed part of the wider late-nineteenth-century protectionist wave that, following earlier unilateral tariff increases in other economies, slowed but did not fully reverse, the first globalization (Williamson, 1996; Jacks et al., 2010). This historical pattern does not map directly onto the present, given the deeper integration of today's world economy and the existence of the GATT/WTO-based multilateral trade system, but it does suggest that fragmentation can begin through persistent bilateral and regional ruptures well before any generalized collapse in global trade becomes visible.

7 Conclusions

Trade wars and broader episodes of trade fragmentation raise fundamental questions about how economies adjust when established trading relationships are disrupted. Yet empirical evidence on the long-run consequences of rising trade barriers remains scarce. This paper addresses this gap by providing a quantitative assessment of a major historical trade war—the Franco-Italian trade war of 1888–1898—combining structural gravity estimation, general equilibrium analysis, and synthetic control methods to measure its impact on bilateral and aggregate trade.

We document large and persistent economic costs. Bilateral trade between Italy and France fell by about 58% during the conflict and remained at similarly depressed levels up to the eve of the First World War, showing no meaningful convergence back to pre-war levels. Although trade was partially redirected toward alternative partners, this adjustment remained incomplete. Aggregating these effects in a general equilibrium framework, we find that Italy's total trade was approximately 12–16% below its counterfactual level over more than two decades. The losses are smaller for France, consistent with Italy's greater pre-war dependence on the bilateral relationship.

These findings highlight three broader lessons about the economic consequences of trade wars. First, trade wars can have highly persistent effects: even after the formal end of the conflict, trade policies may not fully revert to their pre-conflict levels, and bilateral trade flows may fail to recover, implying that temporary increases in trade barriers can generate durable economic consequences. Second, adjustment through trade diversion is limited. While producers and consumers reorient toward alternative markets, these new linkages do not fully replace disrupted trade relationships. Third, the aggregate impact of trade wars depends critically on pre-existing trade patterns, so that disruptions to key bilateral relationships can reduce overall trade integration rather than simply reshuffle trade across partners.

Our results have direct implications for current debates on trade fragmentation. Unlike recent episodes such as Brexit or the U.S.-China trade war, where post-event horizons remain short, the Franco-Italian case allows us to trace adjustment dynamics over more than two decades. This extended perspective provides a rare empirical benchmark for assessing the long-run effects of trade wars. In particular, our findings suggest that the costs of trade fragmentation may be substantial and persistent, and that standard adjustment mechanisms through trade diversion are unlikely to fully restore pre-conflict levels of integration. As such, the results can help inform and discipline quantitative trade models that are increasingly used to evaluate the economic consequences of geopolitical fragmentation.

These findings also point to several directions for future research. An important open question is which mechanisms generate persistence in the aftermath of trade disruptions. Potential explanations include relationship-specific investments, changes in production structure, and barriers to re-entry into previously established markets. Understanding the relative importance of these channels would help clarify why trade relationships do not fully recover after large policy shocks and how the effects of trade fragmentation propagate over time.

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A Quantitative multi-country model

A.1 Description of the model

We use a prototypical trade model that is standard in the applied trade literature. In the model there are N countries. Time is discrete and indexed by t. Each country produces a single good with real output of good i denoted by Q_{it}. The production function takes the Cobb-Douglas form with constant returns to scale. It combines internationally immobile labor (L_{it}) with intermediate inputs (M_{it}):

$$Q_{it} = (A_{it}L_{it})^{\zeta} M_{it}^{1-\zeta}.$$

In this expression, ζ is the share of labor in production and we assume that $0 < \zeta < 1$. The parameter $A_{it} > 0$ denotes labor productivity, which can specific to each country. Labor is supplied inelastically by the population in each country.

Intermediate goods consist of the same bundle of goods as the aggregate entering final consumption. Therefore, the price index for intermediate goods for each firm coincides with the consumer price index. We use the notation P_{it} for this price index. There is perfect competition in all goods markets. Thus, the price of output in country i is given by

$$p_{it} = \kappa(A_{it}, \zeta) w_{it}^{\zeta} P_{it}^{1-\zeta}.$$

The parameter $\kappa > 0$ is a technology parameter that is a combination of productivity and the labor share and w_{it} is the nominal wage rate. We define the value income in country i with the letter Y_{it}. This leads to the following macroeconomic accounting identity:

$$Y_{it} = w_{it}L_{it}.$$

Exports from country i to country j are subject to an iceberg trade cost, denoted by $\tau_{ijt} \geq 1$. Because of arbitrage in the goods markets, the price paid in the destination country j for a good that is exported from the origin country i is

$$p_{ijt} = \tau_{ijt}p_{it}. \tag{2}$$

Let q_{ijt} be the amount of goods that reach the destination country j after netting out the iceberg cost. Expenditure on this good valued at prices in the destination country can is given by

$$X_{ijt} = p_{ijt}q_{ijt}.$$

Consumers in each country have a constant elasticity of substitution (CES) utility function. This function aggregates goods from all origins, as in the models of Armington (1969), Anderson (1979), and Anderson and van Wincoop (2003). The elasticity of substitution σ is greater than one. The consumer's optimization problem leads to the well-known gravity equation

$$X_{ijt} = \frac{p_{ijt}^{1-\sigma}}{\sum_{k=1}^{N} p_{kjt}^{1-\sigma}} E_{jt} = \frac{p_{ijt}^{-\theta}}{\sum_{k=1}^{N} p_{kjt}^{-\theta}} E_{jt} = \frac{p_{ijt}^{-\theta}}{P_{jt}^{-\theta}} E_{jt}. \tag{3}$$

In this expression E_{jt} denotes expenditure, which is defined by $E_{jt} \equiv \sum_i X_{ijt}$. The parameter $\theta \equiv \sigma - 1 > 0$ is known as the *trade elasticity*. Replacing the international arbitrate equation (2) in (3), we can also write the gravity equation in terms of bilateral trade costs:

$$X_{ijt} = \frac{(\tau_{ijt}p_{it})^{-\theta}}{\sum_{k=1}^{N} (\tau_{kjt}p_{kt})^{-\theta}} E_{jt} = \frac{(\tau_{ijt}p_{it})^{-\theta}}{P_{jt}^{-\theta}} E_{jt}. \tag{4}$$

Equilibrium requires that output markets clear. Prices and quantities in all countries adjust so that real output Q_{it} in each country equals the aggregate demand from all countries, including from itself, and including also the part that is lost to iceberg costs:

$$Q_{it} = \sum_{j=1}^{N} \tau_{ijt} q_{ijt}.$$

Trade deficits are defined as $D_{it} \equiv E_{it} - Y_{it}$. These trade deficits follow an exogenous process. Trade deficits of all countries in the world sum to zero. With the description given up to this point, the model is a real model, i.e., it determines only relative prices and price levels are indeterminate. We normalize price levels with the standard assumption that world income follows an exogenous process given by $\{\overline{Y}_t\}$:

$$\sum_i Y_{it} = \overline{Y}_t,$$

where each $\overline{Y}_t$ is a strictly positive scalar.

Although all quantities and prices in this model depend on t, the model can be analyzed using the tools and economic theory developed for static trade models. The reason is that the model does not contain any equations that link different time periods together. In fact, taking each date t separately, this model is a (static) universal gravity model, as defined by Allen et al. (2020). Counterfactual simulations for models of this kind require only minimal information: bilateral trade flows in a baseline equilibrium, the trade elasticity θ, and the *supply elasticity* $\psi \equiv (1 - \zeta)/\zeta$.

A.2 Comparative statics

We adopt the "hat algebra" notation introduced by Dekle et al. (2008). We define $\hat{x} \equiv x'/x$, where x is the value of any variable in a baseline equilibrium and x' is the value of the same variable in a counterfactual equilibrium. Given the lack of dynamics in the model, we omit the subscript t in what follows. The comparative statics to changes in bilateral trade costs of real output, income, and the real wage in response can be expressed as a function of the change in equilibrium prices as follows:

$$\begin{aligned}
\hat{Q}_i &= \frac{\hat{w}_i}{\hat{p}_i} = \left(\frac{\hat{p}_i}{\hat{P}_i}\right)^{\psi}, \\
\hat{Y}_i &= \hat{p}_i \hat{Q}_i = \frac{\hat{p}_i^{1+\psi}}{\hat{P}_i^{\psi}}, \\
\frac{\hat{w}_i}{\hat{P}_i} &= \left(\frac{\hat{p}_i}{\hat{P}_i}\right)^{1+\psi}
\end{aligned}$$

Moreover, after defining the trade-deficit-to-income ratio as

$$\delta_i \equiv \frac{D_i}{Y_i},$$

comparative statics for welfare (denoted by W) are given by

$$\hat{W}_i = \frac{1 + \delta_i \hat{\delta}_i}{1 + \delta_i} \frac{\hat{w}_i}{\hat{P}_i}.$$

This expression for welfare is a strict generalization of the formula obtained for balanced trade. Trade deficits are assumed to be constant. Therefore, only the denominator of δ changes. Hence, the change in the deficit-to-income ratio $\hat{\delta}$ is

$$\hat{\delta}_i = \frac{1}{\hat{Y}_i} = \frac{\hat{P}_i^{\psi}}{\hat{p}_i^{1+\psi}}.$$

With this last equation we have expressed all comparative statics in terms of the change in equilibrium prices. The next section shows how prices can be computed.

A.3 System of equations for price changes

Let

$$E_i = \Xi \xi_i p_i Q_i,$$

with $\xi_i > 0$ for all i and

$$\Xi = \frac{\sum_i p_i Q_i}{\sum_i \xi_i p_i Q_i}.$$

The introduction of the factor Ξ and of the country-specific parameters ξ_i serves as a flexible way of modeling trade deficits. It was introduced by Allen et al. (2020) and we refer to their paper for further details. As with all other variables, the change in these new variables is calculated as $\hat{\Xi} \equiv \Xi'/\Xi$ and $\hat{\xi}_i \equiv \xi_i'/\xi_i$, respectively. Under the assumption of constant trade deficits, price changes solve a system of $3N+1$ non-linear equations. Campos et al. (2025) prove that this system of equations takes the form:

$$\begin{aligned}
\hat{p}_i^{1+\theta+\psi}\hat{P}_i^{-\psi} &= \hat{\Xi}\sum_j \left[\frac{X_{ij}}{Y_i}\right](\hat{\tau}_{ij})^{-\theta}(\hat{P}_j)^{\theta}\hat{p}_j\hat{\xi}_j\left(\frac{\hat{p}_j}{\hat{P}_j}\right)^{\psi}, \quad i = 1,\dots,N \\
\hat{P}_i^{-\theta} &= \sum_j \left[\frac{X_{ji}}{E_i}\right]\hat{\tau}_{ji}^{-\theta}\hat{p}_j^{-\theta}, \quad i = 1,\dots,N, \\
\hat{\xi}_i &= \frac{1}{\hat{\Xi}}\left(1 + \frac{\delta_i}{1+\delta_i}\left(\frac{\hat{P}_i^{\psi}}{\hat{p}_i^{1+\psi}} - 1\right)\right), \quad i = 1,\dots,N, \\
\hat{\Xi} &= \frac{1}{\sum_{i=1}^N \hat{\xi}_i \frac{\hat{p}_i^{1+\psi}}{\hat{P}_i^{\psi}}(E_i/\overline{Y})}.
\end{aligned}$$

A.4 Structural interpretation of the empirical gravity equation

To make the connection between this theoretical gravity equation and the empirical gravity equation, we start by taking the natural logarithm and then the exponential on both sides of the gravity equation. The equation now becomes

$$X_{ijt} = \exp\left(-\theta\ln\tau_{ijt} - \theta\ln p_{it} - \ln\sum_{k=1}^N(\tau_{kjt}p_{kt})^{-\theta} + \ln E_{jt}\right).$$

Notice that τ_{ijt} is the only variable on the right hand side of the gravity equation that varies simultaneously by exporter, importer, and time. The good price p_{it} is specific to the exporter and $\sum_{k=1}^N(\tau_{kjt}p_{kt})^{-\theta}$ and expenditure E_{jt} are specific to the importer.

To tie the model to the estimating equation in (1), we specify the following parametric form for bilateral trade costs:

$$-\theta\ln\tau_{ijt} = \beta_0 + \beta_{\text{TW}}\text{Trade War}_{ijt} + \beta_{\text{PTW}}\text{Post Trade War}_{ijt} + \boldsymbol{\beta}_Z'\boldsymbol{Z}_{ijt} + \gamma_t b_{ij} + \tilde{\phi}_{it} + \tilde{\psi}_{jt} + \omega_{ij}.$$

This parametric form approximates the bilateral and time-varying components of trade costs by the indicators of the trade war plus the various bilateral indicators in the vector $\boldsymbol{Z}_{ijt}$, and the globalization trend implied by the process $\{\gamma_t\}$. Bilateral trade costs can also have an exporter-time, and importer-time, and a bilateral fixed effect. The theoretical gravity equation maps into its empirical counterpart by letting

$$\begin{aligned}\phi_{it} &\equiv \tilde{\phi}_{it} - \theta \ln p_{it},\\ \psi_{jt} &\equiv \tilde{\psi}_{jt} - \ln \sum_{k=1}^{N} (\tau_{kjt} p_{kt})^{-\theta} + \ln E_{jt},\end{aligned}$$

yielding the estimating equation (1).

A.5 Counterfactual trade costs

We perform simulations in which we remove the effect of the trade war. Bilateral trade costs in a counterfactual world without the Franco-Italian trade war are given by

$$\theta \ln \tau'_{ijt} = \begin{cases} \theta \ln \tau_{ijt} + \hat{\beta}_{\mathrm{TW}}, & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1888 \leq t \leq 1898,\\ \theta \ln \tau_{ijt} + \hat{\beta}_{\mathrm{PTW}}, & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1898 < t \leq 1913,\\ \theta \ln \tau_{ijt}, & \text{otherwise.} \end{cases}$$

Both $\hat{\beta}_{\mathrm{TW}}$ and $\hat{\beta}_{\mathrm{PTW}}$ have an expected negative sign, so that $\tau'_{ijt} \leq \tau_{ijt}$. We define the change in bilateral trade costs as $\hat{\tau}_{ijt} \equiv \tau'_{ijt}/\tau_{ijt}$, so that

$$\hat{\tau}_{ijt} = \begin{cases} \exp\left(\hat{\beta}_{\mathrm{TW}}/\theta\right), & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1888 \leq t \leq 1898,\\ \exp\left(\hat{\beta}_{\mathrm{PTW}}/\theta\right), & \text{if } i \text{ and } j \text{ denote Italy and France, in any order, and } 1898 < t \leq 1913,\\ 1, & \text{otherwise.} \end{cases}$$

A.6 Calibration

Counterfactual simulations with this model require only minimal information, specifically bilateral trade flows in a baseline year, the assumed change in trade costs in the counterfactual simulation, a value of the trade elasticity θ, and a value of the sensitivity of output to the export price (i.e., the *supply elasticity*).

As explained in the text, we set the trade elasticity θ, which influences how changes in bilateral trade costs affect bilateral trade flows, to 5, and we set the supply elasticity to 1.

A.7 Simulation

We simulate the model by first solving for the changes in equilibrium prices using the system of equations implied by the model. Once this alternative path for all prices has been computed, we use the change in prices to compute the evolution of trade flows and welfare implied by those prices.

B Implementation details of the synthetic control method

B.1 Methodology

This appendix provides additional details on the implementation of the synthetic control method used in the main text. The treated units are *directed bilateral trade relationships*: specifically, Italy's export share to France and Italy's import share from France. The donor pool consists of directed country pairs that do not involve either Italy or France.

Let Y_{0t} denote the outcome of interest for the treated unit in year t, where the outcome is either Italy's export share to France or Italy's import share from France. Let Y_{jt} denote the corresponding outcome for donor unit $j = 1, \ldots, J$, where each donor unit is a directed country pair. For a given set of time-invariant donor weights w_j, the synthetic control is defined as the weighted average

$$\hat{Y}_t(\mathbf{w}) \equiv \sum_{j=1}^{J} w_j Y_{jt}, \tag{5}$$

where the donor weights satisfy

$$w_j \geq 0, \qquad \sum_{j=1}^{J} w_j = 1. \tag{6}$$

To choose the donor weights, we match the treated unit to the donor pool on a set of K pre-treatment characteristics. For each donor unit j, let $\mathbf{Z}_j$ denote the $K \times 1$ vector of matching characteristics, and let $\mathbf{Z}_0$ denote the corresponding vector for the treated unit. In the baseline implementation, these matching characteristics consist exclusively of lagged values of the outcome variable over the full pre-treatment period 1873–1886. Thus, the synthetic control is chosen to reproduce as closely as possible the entire pre-war trajectory of Italy's trade share with France. For a given vector of predictor weights $\mathbf{v}$, the donor weights are chosen to minimize

$$\mathbf{w}^*(\mathbf{v}) = \arg\min_{\mathbf{w}} \sum_{k=1}^{K} v_k \left(Z_{k0} - \sum_{j=1}^{J} w_j Z_{kj} \right)^2. \tag{7}$$

The predictor weights $\mathbf{v}$ are selected using a data-driven criterion. Specifically, we choose $\mathbf{v}$ to minimize the mean squared prediction error (MSPE) of the outcome variable over the pre-treatment period 1873–1886:

$$\mathbf{v}^* = \arg\min_{\mathbf{v}} \frac{1}{14} \sum_{t=1873}^{1886} \Big(Y_{0t} - \hat{Y}_t(\mathbf{w}^*(\mathbf{v})) \Big)^2. \tag{8}$$

The final synthetic control is then constructed using the donor weights implied by $\mathbf{w}^*(\mathbf{v}^*)$.

Our period of interest is 1888–1913, excluding the transition year 1887 and the start of World War I. In the baseline specification, the donor pool consists of directed bilateral trade relationships that do not involve Italy or France, either as exporter or importer. We further exclude donor units with missing observations over the sample period and restrict attention to countries with at least five trading partners on average. These restrictions yield a donor pool of 272 directed country pairs.

To assess the plausibility of the estimated treatment effects relative to untreated units, we conduct in-place placebo exercises. For each donor unit, we re-estimate the synthetic control as if that unit had been treated in 1888, applying the same donor-pool restrictions used in the baseline exercise. In each placebo iteration, we exclude all trade relationships involving either country in the placebo-treated pair, as well as all flows involving Italy or France. This procedure generates a distribution of placebo treatment effects against which the estimated effect for the Italy–France relationship can be compared. Following Abadie et al. (2010), we retain only placebo units with a pre-treatment MSPE no greater than five times that of the treated unit.

In addition to placebo exercises, we assess the sensitivity of the results to donor composition by re-estimating the synthetic control after excluding the most heavily weighted donor units.

B.2 Diagnostics and further results

This subsection reports additional diagnostics on pre-treatment fit, placebo comparisons, donor composition, and robustness to alternative outcome definitions.

B.2.1 Pre-treatment fit and weights

Table B.1 reports summary measures of pre-treatment fit for the baseline synthetic controls. In both the export-share and import-share exercises, the synthetic controls reproduce the pre-1888 evolution of the treated units closely. The small pre-treatment prediction errors support their use as counterfactual benchmarks for the post-1888 period.

Table B.1: Pre-treatment fit of the synthetic controls

	Italy's export share to France			Italy's import share from France		
Statistic	Treated	Synthetic	Difference	Treated	Synthetic	Difference
Mean (1873–1886)	34.58	34.61	-0.04	27.04	27.03	0.02
Std. dev.	4.31	3.47	1.64	3.48	2.56	1.69
Correlation		0.93			0.89	
MSPE		2.49			2.66	
RMSPE		1.58			1.63	

Note: The table reports measures of pre-treatment fit for the synthetic controls used to match Italy's export share to France and Italy's import share from France over the period 1873–1886. The correlation is computed using the observed trade share and its synthetic counterpart. The mean squared prediction error (MSPE) and root mean squared prediction error (RMSPE) are computed using the difference between the observed trade share and its synthetic counterpart over the pre-treatment period.

Table B.2 reports the donor pairs receiving positive weight in the baseline synthetic controls for export and import shares.

Table B.2: Weights assigned to each directed country pair by the synthetic controls

Italy's export share to France		Italy's import share from France	
Directional pair	Weights	Directional pair	Weights
Japan to United States	24.0%	China to Japan	30.4%
Portugal to Great Britain	17.2%	Great Britain to Colombia	27.8%
Colombia to Great Britain	12.7%	Germany to Russia	18.4%
Portugal to Brazil	10.5%	Great Britain to Chile	12.9%
Colombia to United States	10.2%	Spain to Uruguay	5.2%
Japan to the Netherlands	9.5%	Germany to Norway	4.1%
Uruguay to Argentina	8.1%	Great Britain to British India	1.2%
Greece to Russia	7.8%		

Note: The table reports the positive weights assigned by the synthetic control method to donor country pairs. Export shares are defined as bilateral exports relative to total exports, and import shares as bilateral imports relative to total imports. The donor pool contains 272 directed country pairs and excludes all trade flows involving Italy or France.

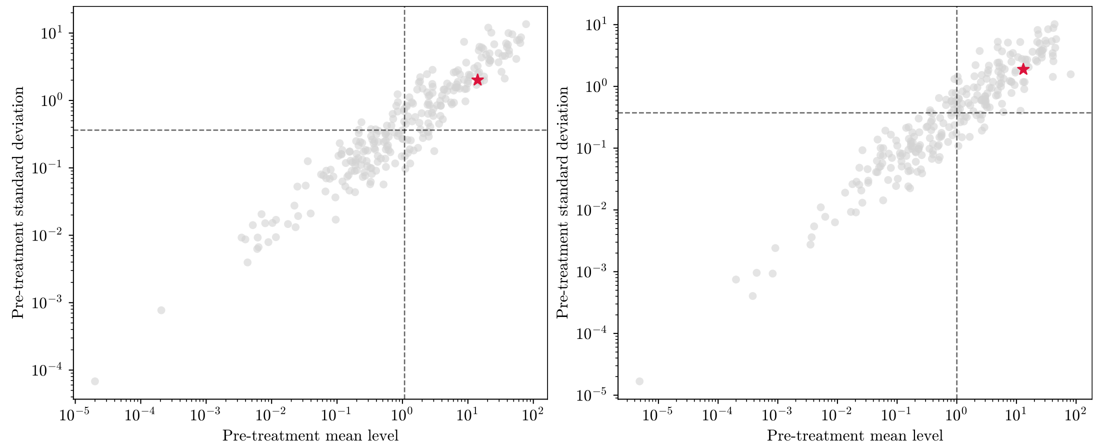
B.2.2 Permutation analysis

Inference is conducted using placebo tests in the spirit of Abadie et al. (2010), whereby the treatment is iteratively reassigned to each unit in the donor pool and synthetic controls are re-estimated. To improve comparability across units, we restrict attention to placebo permutations whose pre-treatment mean squared prediction error (MSPE) does not exceed five times that of the treated unit, following common practice in the literature. Figure 4 in the main text reports the resulting placebo paths together with the estimated treatment effect for Italy's trade with France.

As emphasized in recent work, permutation-based inference using post- to pre-treatment prediction error ratios can be sensitive to heterogeneity in outcome scale and pre-treatment variability across units (Firpo and Possebom, 2018; Hahn and Shi, 2017). This issue is relevant in the present setting because bilateral trade shares differ substantially in magnitude across donor pairs, and a non-trivial subset of placebo units exhibits outcomes that are positive but close to zero and display little variation in the pre-treatment period. These low-scale, low-variation units are often easy to match prior to treatment, but can generate mechanically large placebo ratios in the post-treatment period even when the associated absolute deviations are economically small.

To assess the importance of this issue, Figures B.1 and B.2 summarize the scale and variability of placebo outcomes. Figure B.1 shows that some placebo units cluster near the origin in terms of both pre-treatment mean and pre-treatment standard deviation, indicating outcomes that are small in level and nearly flat before treatment. Figure B.2 shows that the largest post/pre prediction-error ratios are concentrated among precisely these low-variation placebo units. This pattern indicates that the upper tail of the placebo distribution is driven largely by scale effects and flat pre-treatment dynamics rather than by treatment-like post-intervention behavior.

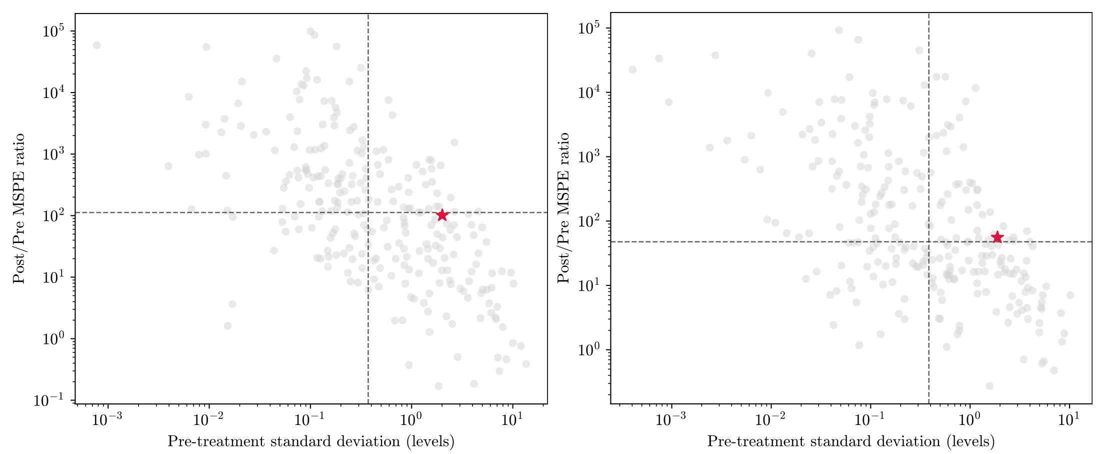
Taken together, these diagnostics suggest that the graphical placebo evidence is more informative in this application than ratio-based permutation summaries taken in isolation. The estimated gaps for Italy's trade with France are economically large, emerge sharply after 1888, and remain persistently negative thereafter. Accordingly, the placebo analysis is most informative when interpreted jointly with the time path of the estimated deviations and the diagnostics on outcome scale and pre-treatment variation.



(a) Italy's export share to France (b) Italy's import share from France

Figure B.1: Pre-treatment outcome scale and variation across placebo units

Note: The figure plots the pre-treatment mean level of the outcome against its pre-treatment standard deviation for the treated unit (in red) and all placebo country pairs (in gray) over the period 1873–1886. The median of each variable is indicated by a dashed line. The log–log scale highlights substantial heterogeneity in outcome scale and variation across placebo units.



(a) Italy's export share to France (b) Italy's import share from France

Figure B.2: Pre-treatment outcome variation and post/pre-treatment MSPE ratios

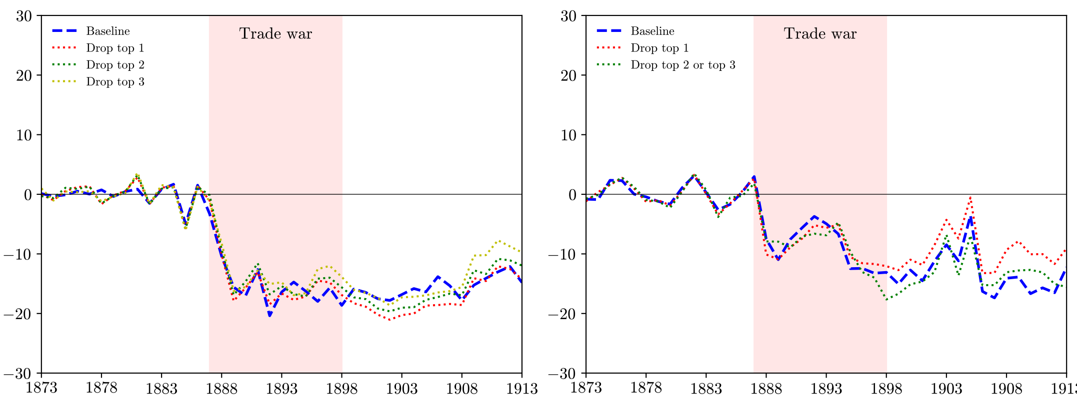
Note: The figure plots, for the treated unit (in red) and all placebo country pairs (in gray), the post- to pre-treatment mean squared prediction error (MSPE) ratio against the pre-treatment standard deviation of the outcome. The median of each variable is indicated by a dashed line. Both axes are displayed on a logarithmic scale to accommodate the wide dispersion of ratios. A pronounced negative relationship is evident: placebo units with near-zero pre-treatment variation generate extremely large MSPE ratios following modest post-treatment deviations. These low-variation units account for the heavy upper tail of the permutation distribution, whereas the treated unit exhibits substantially higher pre-treatment variation and does not drive the extreme ratios.

B.2.3 Leave-one-out robustness

To assess the sensitivity of the SCM results to donor composition, we perform leave-one-out robustness checks that exclude the most heavily weighted donor units from the baseline synthetic control. Specifically, we re-estimate the synthetic control after excluding the top one, top two, and top three donor pairs ranked by their baseline weights, and then compare the resulting deviations from the synthetic control to the baseline estimates.

Figure B.3 reports the results for Italy's export share to France and import share from France. The estimated deviations remain very similar to the baseline across all leave-one-out exercises. For exports, excluding the most heavily weighted donor pairs leads to only minor changes in the magnitude and timing of the estimated effect. For imports, the alternative specifications are likewise very close to the baseline, with some of the leave-one-out paths overlapping exactly. In all cases, the estimated deviations remain sharply negative after 1888 and persist throughout the sample period.

These results indicate that the SCM findings are not driven by a small number of influential donor pairs. Instead, the estimated effects reflect a broader and stable pattern in the data, reinforcing the interpretation that the collapse in Italy–France trade shares was both large and persistent.



(a) Italy's export share to France

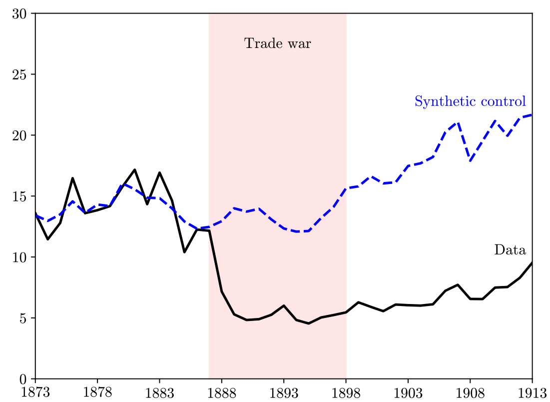
(b) Italy's import share from France

Figure B.3: Leave-one-out robustness of synthetic-control deviations

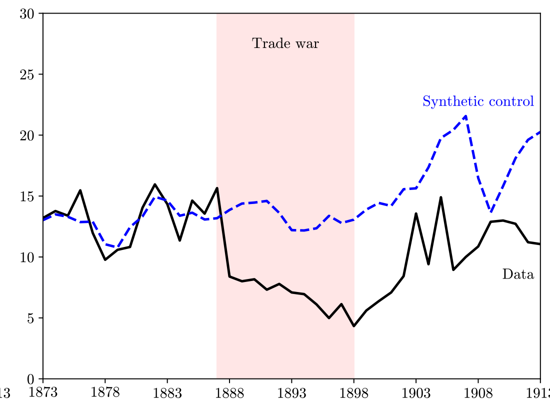
Note: The figure reports deviations between observed trade shares and their synthetic controls for Italy's export share to France (left panel) and import share from France (right panel). The dashed blue line shows the baseline SCM estimate. The additional lines show leave-one-out robustness checks in which the synthetic control is re-estimated after excluding the top one, top two, and top three donor pairs ranked by their baseline weights. In the case of Italy's import share, the result from dropping the top two or top three donors is identical. The shaded area indicates the years of the trade war (1888–1898). The similarity of the estimated deviations across specifications indicates that the results are not driven by a small number of heavily weighted donor units.

B.2.4 Alternative outcome variable: trade flow levels instead of shares

Figure B.4 presents the results when the SCM is implemented on bilateral trade flows instead of trade shares. The qualitative findings are similar to those in the baseline specification: trade between Italy and France falls sharply after 1888 and remains persistently below its synthetic counterpart over the subsequent decades. The gap is larger for exports than for imports. This exercise shows that the main conclusions are not driven by the use of trade shares as the outcome variable.



(a) Italy's export flows to France



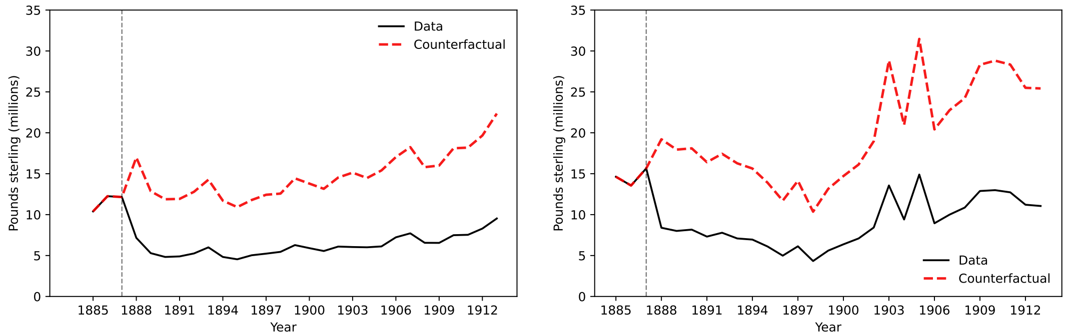
(b) Italy's import flows from France

Figure B.4: Bilateral export and import flows for Italy and France and their synthetic controls

Note: The figures show bilateral trade flows between Italy and France and bilateral trade flows of its synthetic control over the period 1873-1913. Trade flows are nominal and measured in millions of British pounds. The shaded area indicates the years of the trade war (1888–1898).

C General equilibrium simulation results

C.1 Detailed simulation results by year

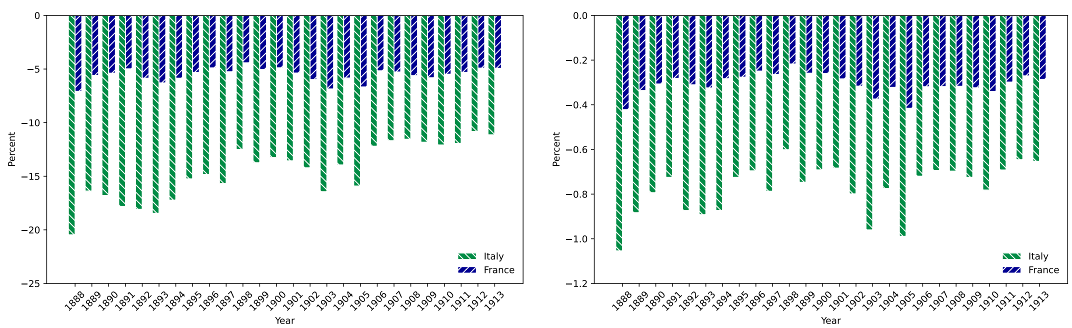


(a) Italy's export flows to France

(b) Italy's import flows from France

Figure C.1: Bilateral trade flows between Italy and France and their counterfactuals

Note: The figures show bilateral trade flows between Italy and France and bilateral trade flows and their counterfactuals simulated with the quantitative multi-country general equilibrium trade model described in Appendix A. Trade flows are nominal and measured in millions of British pounds. The vertical dashed line marks the year 1887



(a) Total trade losses

(b) Welfare losses

Figure C.2: Simulation results: Italy and France

Note: The figures show the deviation in percentage points between observed data and the counterfactual calculated with the quantitative general equilibrium model. Simulations are performed separately for each year from 1888 to 1913.

Table C.1: Trade diversion - Increased trade with Italy: top five countries

Country	Period	Average difference	Growth rate
United Kingdom	1888–1898	251 thousand pounds	2.0%
United Kingdom	1899–1913	438 thousand pounds	2.2%
Germany	1888–1898	92 thousand pounds	0.8%
Germany	1899–1913	327 thousand pounds	1.3%
Russia	1888–1898	110 thousand pounds	2.2%
Russia	1899–1913	227 thousand pounds	2.9%
United States	1888–1898	61 thousand pounds	0.9%
United States	1899–1913	257 thousand pounds	1.3%
Austria-Hungary	1888–1898	109 thousand pounds	1.2%
Austria-Hungary	1899–1913	209 thousand pounds	1.5%

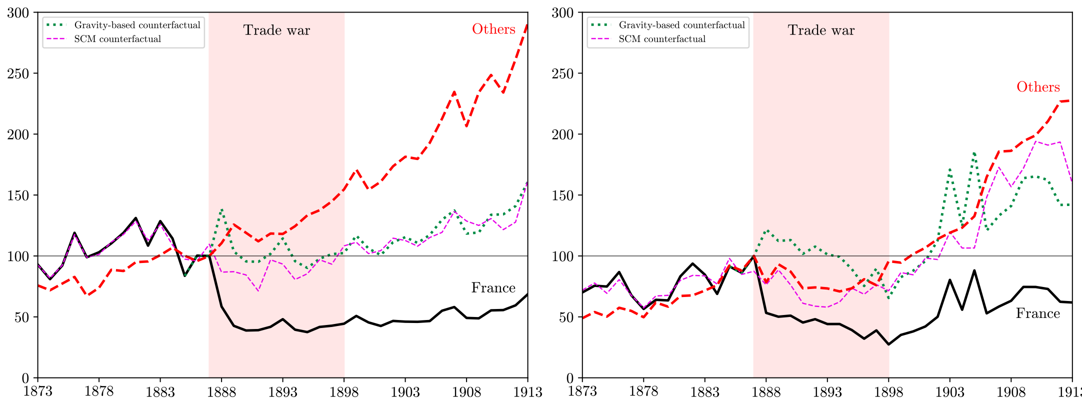
Note: The table reports changes in Italy's bilateral trade with the five partners showing the largest increases after 1888. Changes are computed as the difference between counterfactual trade flows simulated with the multi-country general-equilibrium model described in Appendix A and baseline flows. Simulations are conducted separately for each year from 1888 to 1913. The column "Average difference" shows the absolute change in total bilateral trade (imports plus exports), averaged over 1888–1898 and 1899—1913. All values are nominal. The column "Growth rate" expresses these changes as a percentage of average baseline flows in each period.

Table C.2: Trade diversion - Increased trade with France: top five countries

Country	Period	Average difference	Growth rate
United Kingdom	1888–1898	276 thousand pounds	0.4%
United Kingdom	1899–1913	312 thousand pounds	0.4%
Germany	1888–1898	67 thousand pounds	0.3%
Germany	1899–1913	110 thousand pounds	0.2%
Belgium	1888–1898	40 thousand pounds	0.1%
Belgium	1899–1913	128 thousand pounds	0.3%
Switzerland	1888–1898	51 thousand pounds	0.5%
Switzerland	1899–1913	97 thousand pounds	0.6%
United States	1888–1898	72 thousand pounds	0.2%
United States	1899–1913	62 thousand pounds	0.1%

Note: The table reports changes in France's bilateral trade with the five partners showing the largest increases after 1888. Changes are computed as the difference between counterfactual trade flows simulated with the multi-country general-equilibrium model described in Appendix A and baseline flows. Simulations are conducted separately for each year from 1888 to 1913. The column "Average difference" shows the absolute change in total bilateral trade (imports plus exports), averaged over 1888–1898 and 1899—1913. All values are nominal. The column "Growth rate" expresses these changes as a percentage of average baseline flows in each period.

C.2 Concordance of the GE counterfactual and synthetic controls



(a) Italy's exports

(b) Italy's imports

Figure C.3: Comparison of simulation results and synthetic controls

Note: The figure shows trade normalized so that the 1887 value equals 100. Black solid lines: Italy–France bilateral flows. Red dashed lines: Italy's flows with all other partners. Left: exports; right: imports. Data: Nominal trade data from TRADHIST v4 (Fouquin and Hugot, 2016) adjusted by the purchasing power of the British pound (O'Donoghue et al., 2004, Table 3). Green dotted lines: quantitative multi-country general equilibrium trade model counterfactual bilateral exports (left) and counterfactual bilateral imports (right). Simulations are computed separately for each year 1888–1913. Purple dashed line: SCM counterfactual bilateral exports (left) and SCM counterfactual bilateral imports (right). SCM counterfactuals are obtained by incrementing Italy–France bilateral exports (imports) in the data (the black solid lines) by a fraction of counterfactual total exports (imports) that can be attributed to the trade war according to the synthetic control method. Accordingly, the formula for exports is $\textit{Synthetic exports to France}_t = \textit{Actual exports to France}_t + (gap_t/100) \times \textit{Counterfactual total exports}_t$, where gap_t is the gap in export shares shown as a dashed blue line in panel a of Figure 4. The formula for imports is $\textit{Synthetic imports to France}_t = \textit{Actual imports from France}_t + (gap_t/100) \times \textit{Counterfactual total imports}_t$, where gap_t is the gap in import shares shown as a dashed blue line in panel b of Figure 4.

C.3 Sensitivity to calibration assumptions

Tables C.3 and C.4 report robustness checks for the general-equilibrium results under alternative values of the trade elasticity and the supply elasticity. Two patterns stand out. First, the simulated trade effects are highly stable across calibrations. The bilateral trade loss between Italy and France, the limited extent of trade diversion toward third markets, and the resulting reduction in Italy's total trade all remain very close to their benchmark magnitudes. Second, the welfare effects are more sensitive to the assumed elasticities. In particular, welfare losses are substantially larger under lower values of the trade elasticity and under higher values of the supply elasticity. Thus, the main conclusion that the trade war generated persistent aggregate trade losses is largely calibration-invariant, while the precise welfare magnitudes depend more strongly on the model's structural parameters.

Table C.3: Sensitivity of Italy's general-equilibrium results to the trade elasticity

	$\theta = 1,\ \psi = 1$		$\theta = 5,\ \psi = 1$		$\theta = 10,\ \psi = 1$	
	1888–1898	1899–1913	**1888–1898**	**1899–1913**	1888–1898	1899–1913
Bilateral trade loss (%)	-57.3	-56.7	-57.0	-56.4	-57.0	-56.4
Trade diversion offset (%)	4.3	8.3	5.0	8.4	5.1	8.4
Total trade loss (%)	-16.5	-12.3	-16.3	-12.2	-16.2	-12.2
Welfare loss (%)	-3.9	-3.7	-0.8	-0.8	-0.4	-0.4

Note: The table reports the same general-equilibrium objects as Table 2, but for Italy only and for alternative values of the trade elasticity θ, holding the supply elasticity fixed at $\psi = 1$. The benchmark calibration is $(\theta, \psi) = (5, 1)$. Bilateral trade is defined as total trade between Italy and France, that is, exports plus imports in both directions. Total trade for Italy is defined as total exports plus total imports. The entries for bilateral trade loss and total trade loss are computed from trade flows first summed over all years in the relevant period and then expressed as percentage deviations from the corresponding no-trade-war counterfactual totals. Trade diversion offset is the share of lost bilateral trade with France that is compensated by increased trade with third countries, computed from period totals. Welfare loss is the simple average of the annual percentage welfare deviations relative to the no-trade-war counterfactual within each period.

Table C.4: Sensitivity of Italy's general-equilibrium results to the supply elasticity

	$\theta = 5,\ \psi = 0$		$\theta = 5,\ \psi = 1$		$\theta = 5,\ \psi = 3$	
	1888–1898	1899–1913	**1888–1898**	**1899–1913**	1888–1898	1899–1913
Bilateral trade loss (%)	-56.9	-56.3	-57.0	-56.4	-57.2	-56.6
Trade diversion offset (%)	5.7	9.3	5.0	8.4	3.7	6.8
Total trade loss (%)	-16.1	-12.1	-16.3	-12.2	-16.6	-12.5
Welfare loss (%)	-0.4	-0.4	-0.8	-0.8	-1.6	-1.4

Note: The table reports the same general-equilibrium objects as Table 2, but for Italy only and for alternative values of the supply elasticity ψ, holding the trade elasticity fixed at $\theta = 5$. The benchmark calibration is $(\theta, \psi) = (5, 1)$. Bilateral trade is defined as total trade between Italy and France, that is, exports plus imports in both directions. Total trade for Italy is defined as total exports plus total imports. The entries for bilateral trade loss and total trade loss are computed from trade flows first summed over all years in the relevant period and then expressed as percentage deviations from the corresponding no-trade-war counterfactual totals. Trade diversion offset is the share of lost bilateral trade with France that is compensated by increased trade with third countries, computed from period totals. Welfare loss is the simple average of the annual percentage welfare deviations relative to the no-trade-war counterfactual within each period.

The limited sensitivity of trade flows to alternative values of the trade and supply elasticities can be understood from the structure of the gravity system. In the counterfactual, the bilateral shock is imposed through the term $\hat{\tau}_{ij}^{-\theta}$, which is pinned down by the gravity estimates and therefore remains effectively unchanged across calibrations. By contrast, the remaining general-equilibrium components of the trade equation, namely exporter prices $\hat{p}_i$, destination price indices $\hat{P}_j$, and expenditure $\hat{E}_j$, vary only at the country level. As a result, they shift all exports from a given country or all imports into a given country proportionally, rather than generating large pair-specific reallocations across trading partners. Because these country-level adjustments remain modest in response to a shock that affects a single bilateral relationship, the overall pattern of trade diversion and the implied changes in aggregate trade are largely invariant to the elasticities. At the same time, welfare is more sensitive because it depends on the ratio $\hat{p}_i/\hat{P}_i$, which captures the cost of replacing disrupted trade links and is directly affected by the degree of substitutability across sources.

C.4 Time-varying trade elasticity

As an additional exercise, we allow the trade elasticity to vary over time rather than remain constant throughout the simulation horizon. Specifically, we set the trade elasticity to $\theta = 1$ in 1888 and increase it linearly to $\theta = 5$ by 1898, after which it remains at the baseline value through 1913. This calibration is motivated by evidence that the trade elasticity may be lower in the short run and rise gradually as adjustment unfolds (Boehm et al., 2023).

Table C.5 reports the resulting general-equilibrium effects. The main trade results are essentially unchanged relative to the baseline calibration with a constant trade elasticity. The bilateral collapse in Italy–France trade remains almost identical, the extent of trade diversion toward third countries changes only minimally, and the aggregate trade losses for both Italy and France remain very close to the benchmark results.

The main quantitative difference concerns welfare during the trade-war period. Under the time-varying elasticity calibration, welfare losses are noticeably larger in the years 1888–1898 than in the baseline simulation. For Italy, the average welfare loss during the trade-war years is more than twice as large as in the benchmark case, while France also experiences substantially larger short-run welfare losses. By contrast, once the trade elasticity converges to its long-run value, the post-1898 results are nearly indistinguishable from the baseline.

This pattern is consistent with the role of the trade elasticity in the model. When substitution across trade partners is more limited in the short run, expenditure shares adjust less in response to higher bilateral trade costs, so a larger part of the adjustment occurs through relative prices rather than through trade reallocation. As a result, the disruption generates larger short-run welfare costs even though the implied trade-flow reallocation remains very similar. Overall, this exercise suggests that the baseline specification may understate the short-run welfare costs of the trade war, while capturing well its medium- and long-run implications for trade diversion and aggregate trade losses.

Table C.5: General-equilibrium effects of the Franco–Italian trade war with a time-varying trade elasticity

	Italy		France	
	1888–1898	1899–1913	1888–1898	1899–1913
Bilateral trade loss (%)	-57.1	-56.4	-57.1	-56.4
Trade diversion offset (%)	4.9	8.4	1.5	2.4
Total trade loss (%)	-16.3	-12.2	-5.7	-5.6
Welfare loss (%)	-1.8	-0.8	-0.7	-0.3

Note: The table reports general-equilibrium effects of the Franco–Italian trade war during the trade-war period (1888–1898) and the post-trade-war period (1899–1913), relative to a no-trade-war counterfactual, under a calibration in which the trade elasticity θ rises gradually from 1 in 1888 to 5 in 1898 and then remains at 5 through 1913. The supply elasticity is fixed at $\psi = 1$. Bilateral trade is defined as total trade between Italy and France, that is, exports plus imports in both directions. Total trade for each country is defined as total exports plus total imports. The entries for bilateral trade loss and total trade loss are computed from trade flows first summed over all years in the relevant period and then expressed as percentage deviations from the corresponding counterfactual totals. Trade diversion offset is the share of lost bilateral trade with the partner country that is compensated by increased trade with third countries, computed from period totals. Welfare loss is the simple average of the annual percentage welfare deviations relative to the no-trade-war counterfactual within each period.

D Tariff schedule during the Trade War

Table D.1: Tariffs faced by Italian exports to France (1886–1888)

Good	Unit	Preferential tariff	General tariff	Punitive tariff
		Fr. Cent.	Fr. Cent.	Fr. Cent.
Wine	Hectolitres	2	4.5	20 (barrels); 60 (100 bottles)
Raw silk	Kg	Exempt	Exempt	1
Twisted raw silk	Kg	Exempt	Exempt	2
Olive oil	100 Kg	3	4.5	15
Oxen	Units	3	38	60
Cows	Units	3	20	40
Bulls	Units	3	12	30
Young bulls	Units	3	8	20
Calves	Units	3	8	15
Eggs	100 kg	Exempt	10	20
Raw hemp	100 kg	Exempt	Exempt	3
Combed hemp	100 kg	Exempt	Exempt	4
Unprocessed silk waste	-	Exempt	Exempt	—
Processed silk waste	100 kg	10	10	—
Silk waste single-ply thread ($\leq$ 80,500 meters)	100 kg	75	93	—
Silk waste single-ply thread ($>$ 80,500 meters)	100 kg	120	149	—
Silk waste plied thread ($\leq$ 80,500 meters)	100 kg	86.25	120.9	—
Silk waste plied thread ($>$ 80,500 meters)	100 kg	138	193.7	—
Silkworm cocoons	Kg	Exempt	Exempt	0.25
Rice	100 kg	Exempt	Exempt	8
Fresh citrus	100 kg	2	4.5	8
Fresh carob beans	100 kg	Exempt	0.3	1.75
Fresh grapes	100 kg	Exempt	Exempt	7.5
Other fresh fruit	100 kg	Exempt	Exempt	1
Dried figs	100 kg	Exempt	6	15
Dried grapes	100 kg	6	6	20
Almonds, nuts, etc.	100 kg	Exempt	6	10
Other dried fruit	100 kg	Exempt	8	10
Sulfur	100 kg	Exempt	Exempt	2.5

Note: The source of the data is Del Vecchio (1980).