Thick borders in Franco's Spain: the costs of a closed economy*

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Abstract

Between the 1940s and 1970s, Spain used a variety of economic policies that hindered international trade. Because the mix of tariffs, quotas, administrative barriers, and exchange rate regimes varied greatly over time, the quantification of the effect of the various trade policies on international trade in this period is particularly elusive. In this paper, we use historical bilateral trade flows and a structural gravity model to quantify the evolution of Spain's border thickness, a summary measure of its barriers to international trade. We find that Spain's borders in the period 1948–1975 were thicker than those of any other country in Western Europe, even after the liberalization of trade that started in 1959. These comparatively higher impediments to international trade implied substantial negative effects on consumer welfare. We estimate that accumulated welfare costs over the period 1948–1975 exceed 20% of a year's total consumption.

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1 Introduction

Throughout history, countries have conducted trade policy by relying on a variety of tools, including the use of tariffs, quotas, administrative regulations, import and export prohibitions, and exchange rate regimes. When several trade policy tools are used simultaneously, the quantification of their joint effect on trade flows becomes particularly elusive.

Spain in the years of the Franco regime (1939–1975) is a prominent historical example of a country that applied various trade policy tools to restrict trade; in the early years of this period, trade policy had an explicit objective of achieving economic autarky and used a convoluted system of non-tariff and exchange rate restrictions to achieve this objective. As the views on trade in Spain evolved over time, trade policy was liberalized and the use of tariffs (instead of quotas) increased, especially after 1959. Because of the great variety of trade-hindering tools, and among them the pervasive use of non-tariff measures, so far it has been difficult to answer the seemingly simple question of how closed Spain's economy was for a long stretch of time in the 20th century. In this paper, we set out to answer this question for the period 1948–1975 for the first time and also to quantify the welfare costs induced by Spain's economic isolationism in this period.

To obtain a summary measure of the joint effects of the various trade policy tools used over time, we estimate the evolution of Spain's *border thickness*. This concept, which can be traced back to the early work on border effects started by McCallum (1995), is defined in its modern form by Bergstrand et al. (2015) as an indicator of a country's costs of trading internationally relative to the costs of trading domestically.[1] We employ a standard empirical gravity model of trade, estimated using historical bilateral trade flow data starting in 1948, and trace out the evolution of Spain's border thickness over time.

The resulting estimate of Spain's relative border thickness qualitatively matches the historical record of how trade policies changed over time; borders were extremely thick in the 1940s and 1950s, when an autarky objective was still in place, and they became significantly less thick after a move to trade liberalization in 1959. The year 1959 is considered a watershed moment in Spain's economic history. In that year, the government implemented the so-called Stabilization Plan of 1959, which liberalized various aspects of the economy, including international trade. As shown by Prados de la Escosura and Sanz (1996), economic growth and labor productivity growth accelerated after 1959, as numerous restrictions in the Spanish economy were softened or lifted. However, although border thickness clearly dropped after 1959, the estimates show that barriers to international trade in Spain remained elevated and exceeded those of other Western European countries in the remaining years of the Franco regime. Spain's borders remained thicker than those of Portugal and Greece, for example, and substantially thicker than those of

[1] Recent work by Larch et al. (2021) applies the concept of border thickness to study the ex-ante effects of trade liberalization.

Italy or France. On the European continent, only the Communist bloc members had similarly thick borders.

The prior literature that studied economic policies of this period tended to look at Spain in isolation and celebrated the Stabilization Plan as a significant success. Prior assessments by economic historians range from very enthusiastic takes (e.g., Sardá, 1970, González, 1979, Fuentes Quintana, 1984, Varela, 2004) to assessments that are overall favorable, but with certain caveats related to slow institutional development (e.g., Martín-Aceña and Martínez Ruiz, 2007, Martínez Ruiz and Pons, 2020). The favorable verdict is all but forced upon prior studies because they compare the economic performance of Spain after the 1960s with the truly dismal economic performance of Spain prior to the 1959 Stabilization Plan. In contrast, in this new paper we add an international perspective and show that the change after 1959 was not as exceptional as previously thought. Because border thickness is comparable across countries, our methodology allows to shift the focus from Spain individually to Spain's performance relative to other countries, and reveals that Spain's liberalization of trade over the 1960s was not out of the ordinary in the context of Western European countries.

Because our quantification of border thickness sheds light on the whole period 1948–1975, it can be employed to study questions not directly related to the Stabilization Plan. For example, economic historians, e.g., Carreras and Tafunell (2004), have argued that an incipient trade liberalization took place in the early 1950s. However, using the time series of Spain's border thickness, it is apparent that this liberalization, which affected mainly intermediate and capital goods, did not have a significant impact on the ease of trading goods in general in the period before 1959.

Barriers to trade in the period 1948–1975 implied substantial costs for consumer welfare. We quantify them by leveraging the close connection between empirical gravity models and trade theory; we interpret border thickness as a structural parameter in a theoretical general equilibrium trade model à la Anderson and van Wincoop (2003) and then use this model and the methods developed by Arkolakis et al. (2012) to evaluate the welfare costs implied by Spain's trade policy. We estimate that accumulated welfare costs over the period 1948–1975 exceed 20% of a year's total consumption. Although most of these costs are concentrated before the year 1959, there are considerable welfare costs also in the period after the Stabilization Plan. We estimate that consumption could have been at least 0.4% higher per year in the period 1960–1975 if Spain's border thickness had been that of comparable countries, like Greece or Portugal, or that of a synthetically constructed counterfactual. These welfare costs are substantial if they are compared to the typical gains from trade calculated for trade agreements. Their size is around half of Spain's current welfare gains from belonging to the European Union, as estimated by Mayer et al. (2019), and more than an eighth of Spain's current total welfare gains from trade, as implied by the calculations by Felbermayr et al. (2015), who use methods that are similar to ours.

The paper proceeds as follows. In Section 2, we recount the changes in Spain's trade policy over the period 1936–1975. In Section 3, we explain our empirical strategy and describe the data. In Section 4 we report the estimates of Spain's border thickness and contrast their evolution with Spain's history of trade policy. In Section 5 we compare Spain's border thickness with that of other countries and in Section 6 we report the welfare effects of trade policy calculated with general equilibrium simulations. In Section 7 we offer our final comments and remarks.

2 A brief history of Spain's trade policy

Trade policy in the period 1939–1975 can be divided into two distinct periods: before and after the Stabilization Plan of July 1959. The years before 1959 are frequently called the "economic autarky" period of the Franco regime (e.g., Prados de la Escosura and Sanz, 1996). In this period, economic policies had an explicit objective of attaining a self-sufficient economy, and international trade was subjected to strict administrative barriers and quantity restrictions. The Stabilization Plan of 1959 had the short-term objectives of reducing inflation and averting an impending balance of payments crisis, but also the long term aim of liberalizing international trade and reducing the intervention of the state in the economy in general. In this section we briefly describe the main changes in trade policy and exchange rate policy before and after the Stabilization Plan.

2.1 War and economic autarky

1936–1948

In the years of the Spanish civil war (1936–1939), international trade on both sides of the war was heavily intervened and imports of armaments were prioritized over imports of civilian goods. Certain policies and restrictions from this period survived into later periods. For example, the legal framework that would govern exchange rate policy during the whole Franco regime ("Ley Penal y Procesal de Delitos Monetarios") came into force in November 1938, five months before the end of the civil war. This law made the private holding of foreign currency illegal; it stipulated heavy fines and up to three years of prison time for offenders.[2]

Although Spain did not actively participate in the Second World War, the conflict on the European continent and on the Atlantic limited international trade flows. In the aftermath of the Second World War, European democracies isolated Spain diplomatically because of its prior alignment with Axis countries. This diplomatic isolation also entailed important barriers

[2] The book edited by Martín-Aceña and Martínez Ruiz (2006) analyzes economic policy in general during the Spanish civil war; Serrano Sanz and Asensio Castillo (1997) and Martínez Ruiz (2006) describe the evolution of exchange rate policy and trade policy during the civil war.

to international trade with Western Europe. Barriers were sometimes very concrete: in 1946 France closed its border with Spain to exert diplomatic pressure on the Franco regime. By 1948, this isolation started to wane, as the French-Spanish border reopened in February and Spain reestablished diplomatic relations with West Germany.[3] From this point onward, Spain's own trade policy started to play a more important role.

1948–1953

In the period 1948–1953, Spain continued to limit international trade, with an explicit objective of self-sufficiency. Trade in this period was restricted by various quantitative restrictions on imports, including quotas, licensing, bans, permits, and prior import authorization requirements. At the same time, exports were discouraged by an intricate system of multiple exchange rates in which exporters were forced to liquidate foreign currency at an overvalued exchange rate.[4]

1953–1959

In the period 1953–1959, quantitative restrictions on trade flows were kept in place but closer relations with the United States caused an incipient opening of the financial account. In 1953, Spain signed the Pact of Madrid with the United States; Spain obtained financial aid and official loans and, in exchange, the United States obtained permission to construct and to utilize air and naval bases on Spanish territory. The inflow of US dollars ameliorated the lack of foreign currency that restricted the purchase of imports. Because the peseta was not convertible, the access to US dollars allowed to import from countries that did not have a bilateral clearing mechanism with Spain. In parallel, overvaluation became less of a disincentive for exports in the second half of the 1950s; according to calculations by Prados de la Escosura et al. (2011) and Serrano Sanz and Asensio Castillo (1997), the exchange rate faced by exporters started converging to its black market value in this period.

During this period Spain joined multilateral institutions, such as the IMF, the World Bank, and the Organization for European Economic Co-operation, the institution that preceded the OECD.

2.2 The Stabilization Plan and its aftermath

The Stabilization Plan represented a shift to a more orthodox monetary and fiscal policy. It eliminated mechanisms that allowed fiscal deficits to be monetized automatically and gave

[3] The United Nations reversed their ban on having diplomatic relations with Spain in 1950, lifting the last remnants of diplomatic isolation.

[4] Trade policies in the 1950s are analyzed in detail by Martínez Ruiz (2001). Prados de la Escosura et al. (2011) and Serrano Sanz (1997) calculate the black market exchange rate premium between 1939 and 1975, showing that it was at its highest in the early 1950s.

the central bank a more active role in conducting monetary policy, although the central bank did not become fully independent from the Treasury. To avert the balance of payments crisis, Spain obtained bilateral loans from the United States, as well as from other sources—including through a stand-by agreement with the IMF—, and the official exchange rate was devalued by 43%.[5]

Most importantly for trade, the system of multiple exchange rates was definitely abolished, and the peseta became convertible, allowing for multilateral trade relationships. Starting in 1960, quantitative restrictions on several goods were replaced by ad-valorem tariffs, which were gradually reduced over the following years. The plan also allowed foreign direct investment and the participation of foreign capital in Spanish companies.

1960–1975

The years after the Stabilization Plan witnessed a gradual liberalization of trade. Import goods were classified into four separate regimes: liberalized trade, global trade, bilateral trade, and government trade. Liberalized trade was the only one that did not require import licenses. Global trade was a category that contained items that would eventually transition to the liberalized trade regime. Goods in this regime were still subjected to quantitative restrictions but these restrictions did not discriminate by country of origin. Bilateral trade also had quantity limits, but these limits applied individually by country. Finally, government trade referred to goods that were imported exclusively by the government, such as oil and agricultural goods. On the institutional side, Spain joined the GATT in 1963 and signed a preferential trade agreement with the CEE in 1970.

The liberalization of trade was mainly concentrated in the first half of the 1960s. According to Dehesa et al. (1991), the fraction of imports in the liberalized regime rose from 40% in 1960 to 71% in 1966. Tariffs, which were set at initial high levels in 1960, were also progressively reduced. Calculations by Buisán and Gordo (1997) show that the average tariff rate nearly halved over the course of the 1960s, with most of the reduction taking place in the first five years of the decade. Despite of this liberalization drive, trade policy remained complex, with many exemptions that changed over the years. Moreover, on occasion, the government used temporary generalized tariff reductions to ward off inflationary pressures. During this whole period, in addition to tariffs, imports were subjected to a border tax, which was designed to equate taxes on imports with those of locally produced goods but, because of the "cascading" nature of these types of taxes, their final incidence is difficult to measure.

[5] Sardá (1970), who actively participated in the design of the stabilization plan, gives a first-hand account of the plan's main policies and the problems it intended to solve. Martín-Aceña (2017) describes the role of the central bank during this period and Prados de la Escosura et al. (2011) provide further analysis.

3 Empirical strategy and data

Because of the variety of tools employed to restrict trade, a quantitative assessment of how closed Spain was to international trade based solely on tariff rates would be misleading. In fact, prior to 1959, quotas and administrative regulations rather than tariffs were the norm. In addition, many of the non-tariff restrictions from that period can be measured only imperfectly, or have not left a historical record at all. For those that have, combining them into a single indicator can be extremely challenging. For these reasons, we use the concept of border thickness, which measures the combined impact on bilateral trade of all possible observable and unobservable factors that make international trade relatively more costly than domestic trade. Border thickness also has the advantage that it maps directly into how trade costs are introduced into modern general equilibrium trade models.

To estimate border thickness, we define a dummy variable b_{ij} that flags trade flows that cross an international border and, to focus specifically on Spain's borders, we also construct a dummy variable that indicates whether Spain is either the exporter or the importer. Formally, the two variables are defined as follows:

$$b_{ij} = \begin{cases} 1 & \text{if } (i \neq j) \\ 0 & \text{otherwise,} \end{cases} \tag{1}$$

$$b_{ij}^s = \begin{cases} 1 & \text{if } (i \neq j) \wedge (i = \text{Spain} \vee j = \text{Spain}) \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

We estimate an equation of the form:

$$X_{ijt} = \exp(\gamma_t b_{ij} + \theta_t b_{ij}^s + \varphi_{it} + \psi_{jt} + \boldsymbol{\beta}^T \mathbf{z}_{ij}) + \varepsilon_{ijt}. \tag{3}$$

The dependent variable X_{ijt} denotes gross bilateral trade flows between the exporter i and importer j (the special case $i = j$ corresponds to domestic trade) in year t. In addition to the border variables, the specification includes exporter-time fixed effects φ_{it} and importer-time fixed effects ψ_{jt}. These two terms, which are usually called multilateral trade resistance terms in the trade literature, absorb features that vary at the country-year level, such as GDP, inflation, population, etc. Finally, $\mathbf{z}_{ij}$ is a vector of gravity variables (distance, common language, contiguity, and colonial relationship) and ε_{ijt} is an error term in the estimation.

We define border thickness as the semi-elasticity of bilateral trade flows with respect to the presence of an international border, and the coefficients γ_t trace out the evolution of this elasticity over time. Our coefficient of interest, θ_t, captures how much thicker Spain's borders are than those of the rest of the world, i.e., Spain's *relative* border thickness. The border variables b_{ij} and b_{ij}^s capture the impact on bilateral trade of all possible observable and unobservable factors in addition to that of other covariates in the gravity equation. Therefore, all our measures of border thickness are net of the impact of the time-invariant geographical and cultural gravity variables, which are also included in the specification.[6]

As is now standard in the trade literature, we employ a Poisson pseudo-maximum likelihood (PPML) estimator (Santos Silva and Tenreyro, 2006), which allows to properly account for trade values that are zero in some bilateral relationships, and with heteroskedasticity, a typical feature of estimations using trade data.

When presenting results, we first transform the estimated coefficients for Spain's relative border thickness into their marginal effect on international trade flows. For the exponential specification in (3), the formula is:

$$100 \times \frac{\mathbb{E}[X_{ijt}|b_{ij}=1, b^s_{ij}=1] - \mathbb{E}[X_{ijt}|b_{ij}=1, b^s_{ij}=0]}{\mathbb{E}[X_{ijt}|b_{ij}=1, b^s_{ij}=0]} = 100 \times [\exp(\hat{\theta}_t) - 1], \tag{4}$$

where the notation $\hat{\theta}_t$ refers to the point estimates obtained, one for each year in the sample. The transformation re-expresses the Spain's relative border thickness parameter as a percent deviation from a comparison group (in this case, all trade flows not involving Spain). By construction, the range of possible values of these deviations lies in the interval $[-100, +\infty)$. At the lower extreme of this interval, a value of -100 implies that Spain's borders are impenetrable and that trade flows crossing Spain's borders are 100% less than those of the comparison group (and therefore equal to zero). At -50, Spain's borders allow to pass 50% less international trade than the comparison group, at 0 exactly the same as the comparison group, and so on. Positive values imply thinner borders and higher trade flows than the comparison group.

Our approach is in the spirit of the influential trade cost measure computed by Jacks et al. (2008), Jacks et al. (2010), and Jacks et al. (2011) to study globalization over long time horizons, but differs from it in a way that is important for our question at hand. Among the similarities, both approaches use the same family of economic models to map data into trade costs. The main difference is that in our approach border effects are, by construction, net of bilateral factors that ease or hinder trade and remain constant over time, such as distance, and the existence of colonial ties. This is convenient because it allows for a direct comparison across countries focusing on the level of the indicator, and not only on the variation. Moreover, because border effects are obtained through an estimation, and not a calibration, they can be used for econometric inference; it is possible to calculate and report confidence bands for the estimated border thickness and hypotheses, such as whether border effects faced by a given country were higher in one period or another, can be directly tested using standard t-tests.

Our methodology identifies border thickness as the transformation of the time varying coefficient

[6] Border thickness is an average of inward and outward costs of trade. In the appendix we show that inward and outward border thickness cannot be identified separately in the presence of inward and outward multilateral resistance terms.

of Spain's border dummy variable $\hat{\theta}_t$. It can be argued that this coefficient captures too much because it is affected by any factor that produces variation in Spain's international trade flows relative to its domestic trade flows, regardless of the nature of this factor. Factors that are not trade-related but which make trading internationally with a certain destination more difficult will also show up as increased border thickness. Because our specification includes multilateral resistance terms (i.e., exporter-time and importer-time fixed effects), the confounding factors would need to affect domestic and international trade flows differently and vary at the bilateral level, and not at the country level, to have an effect. At the same time, these confounding factors cannot be constant in time because they would otherwise be captured by the standard gravity variables which vary bilaterally and are included in our specification. In Appendix C we repeat our estimation replacing the standard gravity variables with bilateral fixed effects and observe that the evolution of Spain's border thickness is identical to our baseline specification. This suggests that the gravity variables do a good job in capturing the time-invariant bilateral factors. Therefore, the only way in which extraneous factors could affect the border thickness measure is if they have a different impact on domestic and international trade and vary both at the bilateral level and through time. Furthermore, in our analysis we study not only Spain's evolution in isolation, but also in relation to other countries. This is an additional safeguard because certain types of time-variation at the bilateral level may cancel out.

Despite of these arguments, the fact remains that our measure of border thickness is an indirect measure of policies during 1948–1975. This has the desirable consequence that it captures the overall effect of various dissimilar policies that are difficult to quantify, and also the advantage of being exogenous by construction. This flexibility comes at the cost that we cannot dispel the concern that some of the variation is tied to factors unrelated to government policy, and which we would prefer to exclude. Therefore, a reasonable interpretation of the border thickness summary measure, and the one we have implicitly adopted in this study, is that it describes barriers to trade *during* the Franco regime, whether they were ultimately *caused* by the Franco regime's policies or not.

Our data on trade flows are from version 4 of the TRADHIST database (Fouquin and Hugot, 2016). This database compiles historical bilateral trade flows of goods over our period of interest taken from various sources. For our period of study, most of the data in the TRADHIST database is originally from the DOTS database from the IMF. Trade flows are gross, expressed in nominal terms, and measured in the same currency (British pounds). As is usual in trade regressions, we estimate all our regressions using nominal trade data. The presence of country-time fixed effects accounts for differential inflation between countries. We construct domestic trade flows for each country as the difference between nominal GDP (also from the TRADHIST database) and nominal total exports.[7] We also use distance, common language, contiguity, and colonial

[7]Using gross production instead of GDP would be a more theory-consistent way of constructing domestic trade flows, but there are no good internationally-comparable sources for gross production for our period of analysis. Moreover, Campos et al. (2021) show that the presence of country and time fixed effects in gravity

relationship from this same database. Data are yearly. Because of the anomalous Second World War years, and the scarcity of data before 1948 in the database, we use 1948 as the first year for the estimation. We extend the time frame for estimation beyond the end of Franco regime and include the years 1976–1985. Although these later years are not the focus of our analysis, they are useful to construct counterfactual exercises, as we explain in Section 6.

Our final dataset contains 791,622 observations on bilateral trade flows, including domestic flows. As is usual with bilateral trade data, a large fraction of these trade flows (almost 58%) are zero. Spain appears as the origin country (the exporter) in 0.84% of the observations and as the destination country (the importer) also in 0.84% of the cases. We analyzed the provenance of the data for Spain in TRADHIST over the period 1948–1985. For flows where Spain is the exporter, roughly 90% of the data are sourced originally from the DOTS database, 8% from a historical series produced by economic historian Antonio Tena and the remainder from other sources. When Spain is the importer, 74% of the observations are from DOTS, 24% from Tena and the remainder from other sources. For the whole dataset, the source of most of the data (96% of the observations) is the DOTS database from the IMF.

4 The evolution of Spain's border thickness

We show our baseline estimates of Spain's relative border thickness in Figure 1. We transform the coefficients obtained from the estimation of the specification in (3) into marginal effects measured in percentage deviations, as in (4). Over the whole period, Spain was more closed than the average country, although its relative border thickness decreased over time, from 70% thicker than average in 1948 to 40% thicker in 1985.

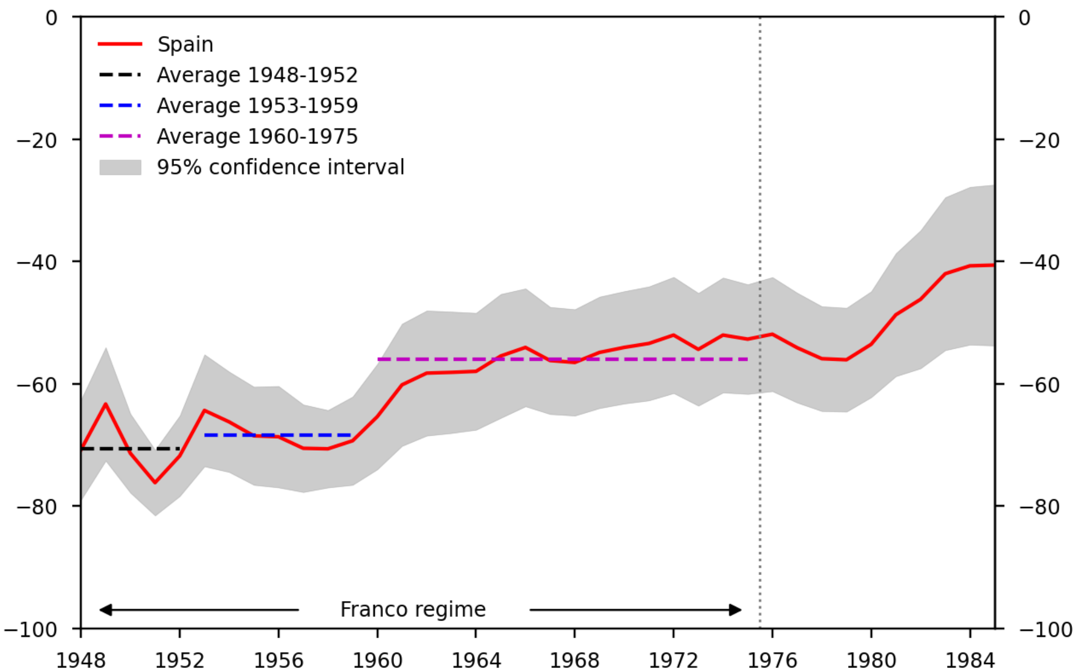
4.1 Results by period

1948–1959

During this period we find the largest values of Spain's borders relative thickness, hovering around 70%. In particular, a statistical test comparing the mean of the yearly estimates does not reject equality between the periods 1948–1952 and 1953–1959 (the null hypothesis of equality is rejected with a p-value $p = 0.316$). The lower overvaluation of the peseta and the arrival of US funds after 1953 do not seem to have had an important effect on Spain's relative border thickness. This result is in line with findings by Martínez Ruiz (2001), who reports that Spanish authorities rejected between 75% and 85% of import requests each year in the period 1951–1958, indicating that the authorities did not relax controls on imports in that period.

equations makes the distinction between GDP and gross output less relevant in practical applications.

Figure 1: Spain's relative border thickness



Notes: The figure plots the estimated relative thickness of Spain's borders measured as the percent deviation of Spain's border effect from the border effect of a typical country. The estimation uses the specification in (3). Marginal effects are constructed from estimates $\hat{\theta}_t$ using the transformation $100 \times [\exp(\hat{\theta}_t) - 1]$. Note that thicker borders imply more negative values. The 95% confidence interval for these marginal effects is calculated using the delta method. The averages shown are arithmetic averages of marginal effects over years belonging to three different time periods: 1948–1952, 1953–1959, and 1960–1975.

The year-by-year evolution of border thickness during this period aligns well with the historical record. After the end of diplomatic isolation in 1948, Spain's ability to trade internationally initially improved. However, the low level of international reserves and the lack of capital inflows seems to have led authorities to progressively restrict trade until the arrival of funds from the United States in 1953. In the remaining years before the Stabilization Plan, reserves again started to dwindle. To prevent a balance of payments crisis, it is foreseeable that authorities would have increased their efforts to limit imports again.

1960–1975

After the Stabilization Plan, average relative border thickness dropped by roughly 10 percentage points reaching an average of around 58%. The difference in averages before and after the Stabilization Plan is significant in the statistical sense (the null hypothesis of equality is rejected with a p-value $p = 3.53 \times 10^{-6}$). After the initial drop, we find very little variation during the period. Again, the plot in Figure 1 aligns well with historical events. Spain's relative border thickness decreases mostly during the first half of the 1960s decade, the years in which imports were primarily liberalized. After the agreement with the CEE in 1970, border thickness starts falling again, albeit at a lower pace.

The last years in our sample, after 1975, show an initial increase of Spain's border thickness—coinciding with the second international oil crisis (1977–1978), followed by a reduction culminating in the year prior to Spain's entry into the EC (1986).

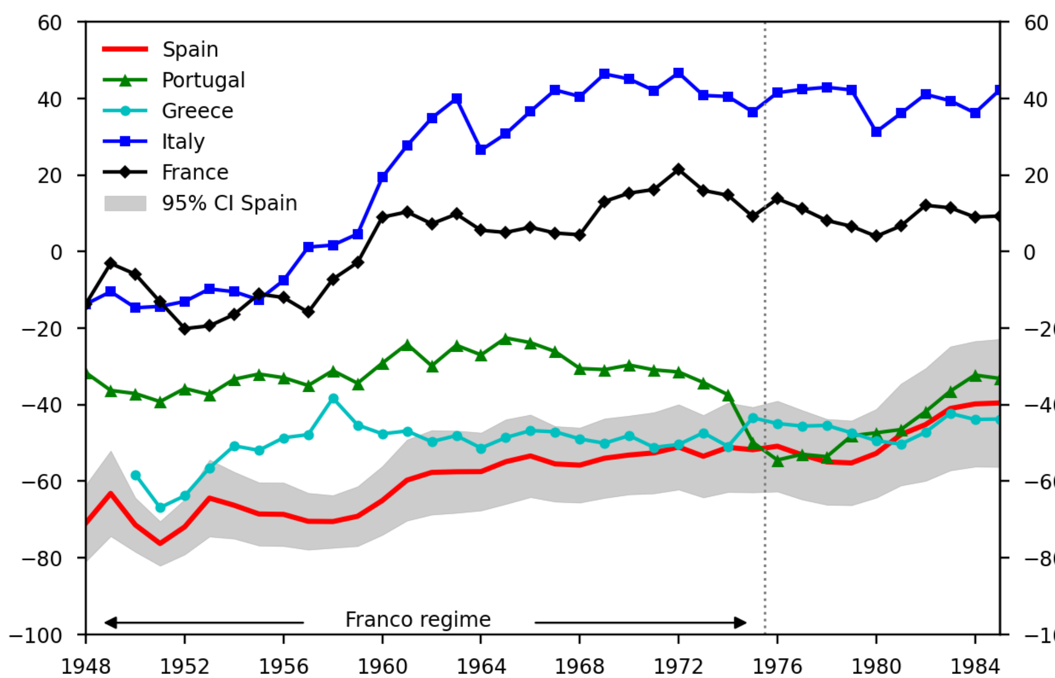
5 International comparison

Figure 2 shows Spain's relative border thickness next to that of selected continental European countries. We focus on France, Greece, Italy, and Portugal. These countries provide an interesting range of variation with common grounds; they are relatively close to Spain in geography, culture, and—with the exception of Greece—also language. At the same time, they are different along dimensions such as participation in the Second World War and government form. We construct country-specific border variables for these countries, as we did for Spain, and add them to the baseline regression. The interpretation of the coefficient of interest is now slightly different. For each country, it measures the relative border thickness with respect to the rest of the world, but the definition of rest of the world now excludes these five countries. Because trade by these five countries is small relative to the world, the world aggregate is mostly unchanged, and the point estimates for Spain are virtually identical to those obtained before.

As discussed in the section describing the methodology, the only way in which extraneous factors could affect the border thickness measure is if they vary both at the bilateral level and through time. The international comparison in this section provides an additional safeguard because at least certain types of time-variation at the bilateral level will cancel out. Moreover, the fact that the excluded group of countries changes between Figures 1–3 while the time-variation of Spain's border thickness remains qualitatively similar, suggests that the comparison between countries does not present major problems, at least in the European context.

The comparison to Greece, Italy, and Portugal also helps in accounting for the change in the importance of services over time. Our calculation of domestic trade as the difference between GDP and exports may be sensitive to the size of the service sector because exports only comprise goods whereas GDP also includes services, including tourism. Because tourism increased in importance in Western European countries in the 1960s, taking Spain in isolation may overstate the thickness of borders after the 1960s, precisely in the period after the Stabilization Plan. Greece, Italy, and Portugal are good benchmarks for the increase in service trade because, toghether with Spain, they were the main recipients of these increased tourism flows.

Figure 2: Spain's relative border thickness compared to selected countries

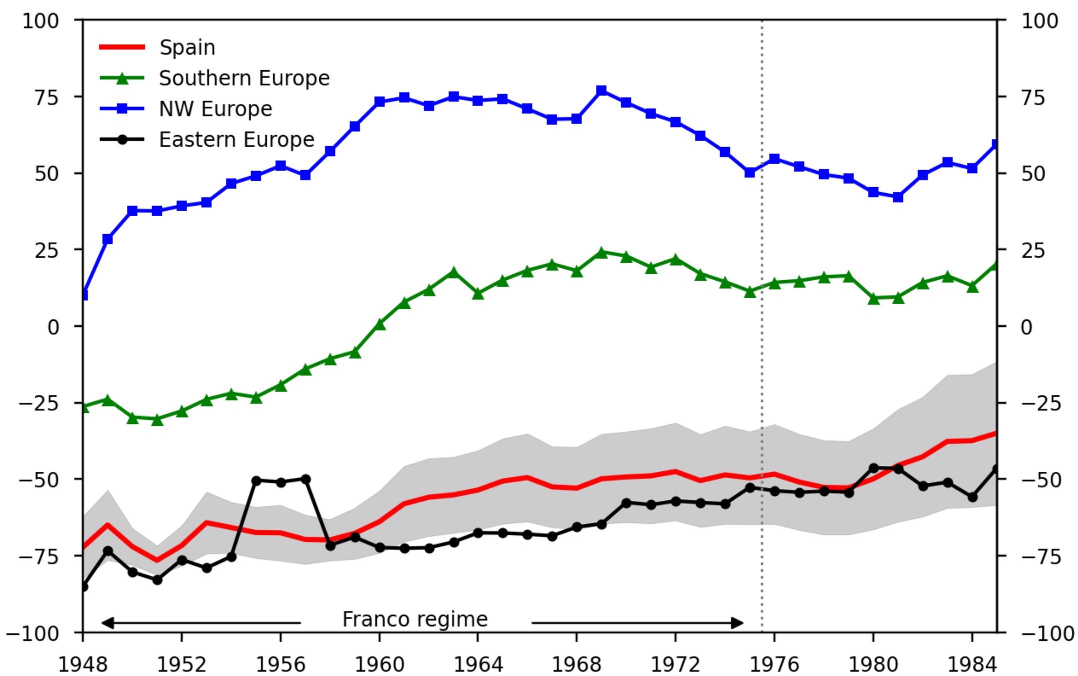


Notes: The figure plots the estimated relative thickness of the borders of selected countries. Relative thickness is measured as the percent deviation from the border effect of the world excluding the countries shown. The estimation uses the specification in (3) augmented by introducing country-specific border dummy variables for France, Greece, Italy, and Portugal. These additional dummy variables are constructed using the definition in (2) replacing "Spain" for the name for each country, as appropriate. Marginal effects are obtained from estimates $\hat{\theta}_t$ for each country using the transformation $100 \times [\exp(\hat{\theta}_t) - 1]$. The 95% confidence interval for marginal effects is shown only for Spain. It has been calculated using the delta method.

Spain in the period 1948–1975 is clearly an anomaly, with thicker borders in the whole period than the comparison group. Italy and France are qualitatively different from the other countries. They transition towards positive values in the 1950s and 1960s, indicating less trade restrictions than the world average. Portugal and Greece are more similar to Spain, although their borders are less thick, especially before the 10 percentage point change of Spain in the early 1960s.

To gauge how closed Spain is in comparison with a larger group of European countries, we compare its relative border thickness to that of different European country groups. We divide all European countries in the sample into three groups: Northwestern Europe, Southern Europe, and Eastern Europe. The last group contains exclusively countries in the Communist bloc.[8] For the purpose of this comparison, we do not include Spain in Southern Europe. Figure 3 shows that Spain was substantially more closed than the average Western and Southern European country and that it was most similar to the average communist country.

Figure 3: Spain's relative border thickness in the European context



Notes: The figure plots the estimated relative thickness of the borders of Spain and the average relative border thickness of selected regions in Europe. Relative thickness is measured as the percent deviation from the border effect of the world excluding Europe. The estimation uses the specification in (3) augmented by introducing region-specific border dummy variables for North-Western Europe, Southern Europe, and Eastern Europe. Spain is not included in any of these groups. These additional dummy variables are constructed using the definition in (2) replacing "Spain" with the name of each country group, as appropriate. Marginal effects are obtained from estimates $\hat{\theta}_t$ for each country or country group using the transformation $100 \times [\exp(\hat{\theta}_t) - 1]$. The 95% confidence interval for marginal effects is shown only for Spain. It has been calculated using the delta method.

The international comparison sheds a less favorable light on Spain's liberalization process than the picture that emerges from a pure time-series comparison. In the comparison with other

[8]The list of countries in each group is shown in the appendix.

countries, the reduction of trade costs after the Stabilization Plan of 1959 is dwarfed by the persistent gaps relative to other countries in Southern Europe and Northwestern Europe. In fact, the evidence shows that the opening to international trade in the 1960s is not specific to Spain but seems to be a widespread phenomenon across European countries. From the perspective of international trade, the Stabilization Plan, which is often heralded in Spanish history as a major and unique liberalization event when the comparison is made with the country's own past, is better described as a set of policies that was scarcely able to maintain a similar pace of liberalization and increasing openness as the rest of the Western Europe.

6 Quantification of trade and welfare effects

The estimates in the previous section give only the partial equilibrium effect of Spain's border thickness on international trade flows. In this section we quantify the welfare costs of Spain's thick borders using a standard static structural gravity model and expressing it in terms of foregone consumption of a representative consumer in general equilibrium.

6.1 General equilibrium model

We use a version of the Armington model, as described by Anderson and van Wincoop (2003). Because the model is a standard theoretical tool used by trade economists, we give only a brief description of the model in this section and relegate the specification of the full model to the appendix.[9] In the model, consumers care about the goods produced in different locations. They are willing to substitute between goods according to a constant elasticity of substitution $\sigma > 1$. Different goods are produced in each country using only one factor (labor), which is immobile across borders. The technology has constant returns to scale in all countries, but countries potentially differ in their labor productivity. The price of labor is the (average) wage rate w_i, which is also allowed to differ by country. Transporting goods from an origin country i to a destination country j is costly. The resource cost of transportation is modeled by an iceberg trade cost parameter τ_{ij}. The sensitivity of trade flows to trade costs is called the "trade elasticity" and—in this model—it is uniquely determined by consumers' substitution elasticity:

$$\epsilon \equiv -\frac{\partial \ln X_{ij}}{\partial \tau_{ij}} = \sigma - 1 > 0. \tag{5}$$

This elasticity measures the magnitude of the partial equilibrium (*ceteris paribus*) reduction in trade flows induced by an exogenous change in trade costs, as predicted by the model. Obtaining

[9] The Armington model is not only standard, but also generic in the sense that it is isomorphic to a whole class of widely-used structural gravity models. The handbook chapter by Head and Mayer (2014) contains a detailed account of models within this class.

the general equilibrium effect is more involved because a change of trade costs (anywhere in the world) will modify relative prices and wages in all countries, which will in turn affect equilibrium trade flows. We solve for the general equilibrium effect from a change of trade costs from $\{\tau_{ij}\}$ to counterfactual values $\{\tau'_{ij}\}$ using a standard procedure that involves three separate steps.[10] In the first step, we solve the system of equations that implicitly determines the endogenous change in equilibrium wages in response to a change in trade costs. This system does not have a closed form solution and must be solved numerically. In the second step, we use changes in trade costs together with the changes in wages calculated in the first step to derive new equilibrium trade flows. In the third step we calculate the impact on welfare (denoted by V)

$$\frac{V'_j}{V_j} = \left(\frac{\lambda'_{jj}}{\lambda_{jj}}\right)^{-\frac{1}{\epsilon}}, \tag{6}$$

where λ_{jj} is the share of expenditure spent on domestic goods in the data and λ'_{jj} is this same share, as calculated from the model in response to the exogenous change in trade costs. This is the well-known ACR formula (Arkolakis, Costinot and Rodríguez-Clare, 2012), which can be derived for many structural gravity models, including ours, as shown in the appendix. In the last step, once general equilibrium trade flows are known, welfare is completely determined by information contained solely in a country's endogenous change in trade openness and in the trade elasticity.

Because the model is static, we solve it separately for each date t. We calibrate the trade elasticity to a standard value of $\epsilon = 4$ and construct counterfactual sequences of changes in trade costs as

$$\frac{\tau'_{ijt}}{\tau_{ijt}} = \exp[(\theta'_t - \hat{\theta}_t)b^s_{ij}], \tag{7}$$

where $\{\hat{\theta}_t\}$ is the sequence of relative trade thickness parameters estimated for Spain and $\{\theta'_t\}$ is a counterfactual sequence of relative trade thickness parameters.

In the standard static general equilibrium model border thickness affects welfare only through its effect in limiting consumer choice. Recent research shows that the dynamic effects of barriers to trade could be larger than those from static models. For example, Buera and Oberfield (2020) and Perla et al. (2021) show how high trade costs may slow technology adoption and lead welfare losses that are an order of magnitude larger than those of static trade models. In the case of Spain, we suspect that dynamic effects are likely to differ before and after the Stabilization Plan. Prados de la Escosura and Sanz (1996) and Prados de la Escosura and Rosés (2009), among others, document that the pace of capital accumulation and growth accelerated after 1959 and tie this change to the change in the institutional framework after the Stabilization Plan. It is therefore likely that the inefficiencies which give rise to large dynamic gains from trade are more significant in the period before 1959, which would make the autarky period

[10] See the appendix for a more detailed version of the procedure.

more costly in terms of welfare relative to the results from the static model.

The model assumes prices are flexible, also in labor markets, which may not be realistic for Spain in this period. However, as calculated by García Perea and Gómez Salvador (1994), the unemployment rate in Spain before the mid-1970s was relatively low, implying that wages were not too far above their equilibrium values. An advantage of the structural gravity framework is that we do not have to take a stance on the organization of production, or labor markets. The welfare effects in the model are the same as in an endowment economy. This is an instance of what Anderson (2011) calls the modularity of gravity, i.e., the separation of distribution (via trade) from the production side. Heid and Larch (2016) study the presence of minimum wages and search unemployment within a gravity framework and find that welfare effects of trade liberalization in such a setting are magnified. Therefore, we expect that adding labor market frictions to our setting would the raise the negative effect of Spain closedness, so that our results can be considered to be conservative.

6.2 Benchmarks

To quantitatively compare Spain's border thickness to that of other countries, we specify several benchmarks that we then use as model counterfactuals in the general equilibrium exercise. In addition to our comparison countries Greece, Portugal, Italy and France, we also use a data-driven methodology to construct synthetic benchmarks for the comparison.

Our synthetic benchmarks are based in the methodology of the synthetic control method, which was originally proposed by Abadie and Gardeazabal (2003) and extended by Abadie et al. (2010). The synthetic control method is used to estimate the effect of a certain treatment on an outcome of interest by constructing a control from untreated units in a data-driven procedure. The key idea behind the synthetic control method is that using a combination of units may be a better approximation to a counterfactual than using any of the potential control units alone.

Our motivation for constructing synthetic benchmarks differs from what is usually the objective with synthetic controls. In causal inference, synthetic controls are commonly used to approximate an unobserved untreated counterfactual for a treated unit. When used in this way, the obtained counterfactual becomes an input for an estimation of a causal effect. In our case, we construct the synthetic benchmarks to use them as an alternate scenario in a theoretical general equilibrium model, but they are always used *after* the estimation of the parameters of interest. Our synthetic benchmarks have a relatively modest purpose; we use them to design comparative statics exercises in a more agnostic way.

Selecting the weights based on observations before the treatment occurs is neither possible nor desirable in our case. It is not possible because observations for trade are missing for many countries in our dataset in the years before 1948. It is not desirable because, even if data were available, they would be contaminated by the fact that they belong to the completely anomalous years of the Second World War. In fact, also the years before the World War were anomalous because of the occurrence of Great Depression and the related disintegration of global trade networks. For this reason we use the 10-year period after the period of analysis to calibrate our synthetic benchmarks.

It would be unreasonable to claim that the fact that Spain was governed by Franco had no influence on observable variables in the 10 years following his death, and we do not make such a claim. We therefore do not interpret our synthetic benchmarks as true counterfactuals who track the evolution of an alternate version of Spain in which the Franco regime did not exist. Instead, we interpret the synthetically-constructed benchmarks simply as examples of possible trajectories that converge to the border thickness of Spain at the end of the sample period. The alternative would be to use a particular country as a comparison, but this does not seem like a fair comparison, in general. For example, France or Italy exhibit much lower border thickness during 1948–1975 and after, and it is unreasonable to assume that Spain could reach the levels of these countries rapidly, as this would imply an opening to international trade unseen in the data. The synthetic benchmarks are a more believable trajectory to compare to because they are constructed as convex combinations of the actual trajectories of other countries and converge to Spain's border thickness.

We construct synthetic counterfactuals for Spain as weighted averages of relative border thickness estimated for a pool of J countries (called donor countries). Let $\hat{\theta}_{jt}$ be the relative border thickness for countries $j = 1, \ldots, J$ in the donor pool. For given time-invariant country-specific weights w_j that satisfy

$$w_j \geq 0, \quad \sum_{j=1}^{J} w_j = 1, \tag{8}$$

the synthetic benchmark for Spain is defined as the weighted average:

$$\theta'_t \equiv \sum_{j=1}^{J} w_j \hat{\theta}_{jt}. \tag{9}$$

To choose the weights in an optimal way, we focus on K different country characteristics. For each country $j = 1, \ldots, J$ in the donor pool, we denote the set of these characteristics of interest by the $K \times 1$ vector $\mathbf{Z}_j$ with typical element Z_{kj}. The target for these characteristics is the analogous $K \times 1$ vector for Spain, which we denote by $\mathbf{Z^s}$, with typical element Z_k^s. The importance of matching the different characteristics is governed by the $K \times 1$ vector $\mathbf{v}$ of importance weights, with typical element $v_k \geq 0$. These importance weights are normalized to sum to one. The optimal $J \times 1$ vector of weights $\mathbf{w}$ is chosen to minimize the discrepancy between the characteristics of Spain and the weighted average of donor countries (taking $\mathbf{v}$ as given):

$$\mathbf{w}^*(\mathbf{v}) = \arg\min_{\mathbf{w}} \sum_{k=1}^{K} v_k \left(Z_k^s - \sum_{j=1}^{J} w_j Z_{kj} \right)^2 . \tag{10}$$

The solution to this problem depends on $\mathbf{v}$. To select $\mathbf{v}$, we adopt the data-driven criterion by Abadie and Gardeazabal (2003) and Abadie et al. (2010) and choose $\mathbf{v}$ to minimize the mean squared prediction error of estimated relative border thickness over the first 10 years after the death of Franco (1976–1985):

$$\mathbf{v}^* = \arg\min_{\mathbf{v}} \frac{1}{10} \sum_{t=1976}^{1985} \left(\hat{\theta}_t - \sum_{j=1}^{J} w_j^*(\mathbf{v}) \hat{\theta}_{jt} \right)^2 . \tag{11}$$

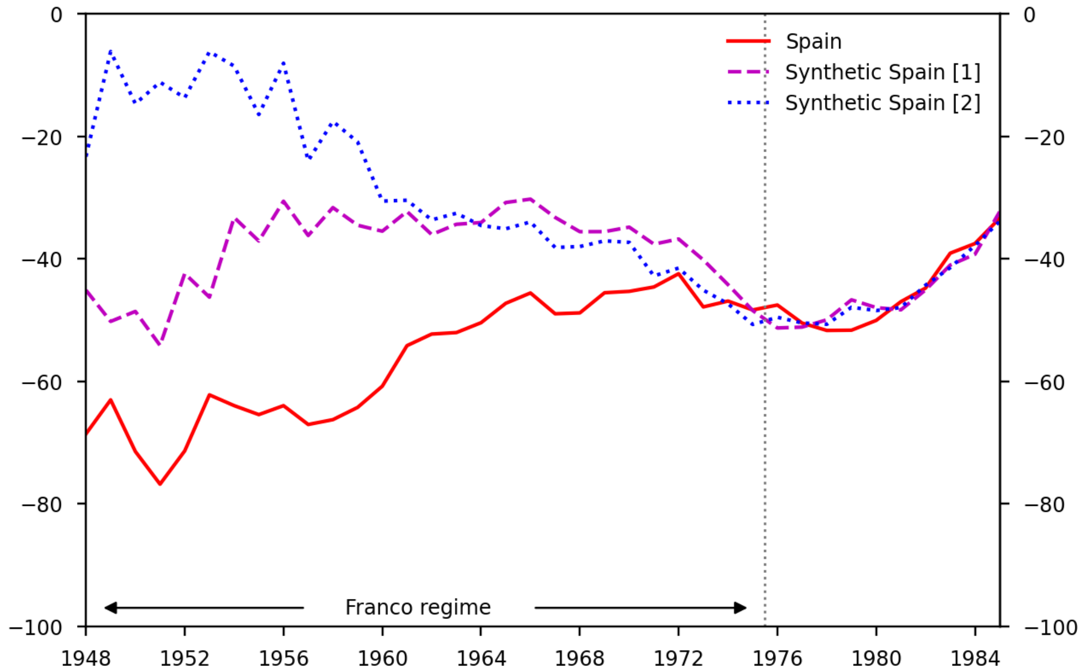
The final counterfactual is then constructed according to (7) using the weights in the vector $\mathbf{w}^*(\mathbf{v}^*)$.

We construct two synthetic benchmarks. They differ in the variables used as the characteristics of interest. The synthetic benchmark should be close to the average estimated relative border thickness in the period 1975–1985. For the first benchmark we select as a criterion the degree of trade openness (the sum of exports and imports over GDP) in all ten years ranging from 1975 to 1985. We calculate trade openness using homogeneous data from the World Bank's development indicators. For this first benchmark, the vectors $\mathbf{Z}_j$ and $\mathbf{Z}^\mathbf{s}$ contain $K = 11$ characteristics. Our first synthetic benchmark is composed of Portugal (34.8%), Mexico (27.2%), Greece (23.3%), Bulgaria (11.8%), Denmark (1.5%), and Netherlands (1.4%).

Spain underwent a process of structural transformation in the 20th century. As described by Prados de la Escosura and Sánchez Alonso (2020), employment in the agricultural sector decreased and moved into the manufacturing sector. Average labor productivity increased in all sectors, including agriculture, which witnessed an increase in mechanization. For our second benchmark, our aim is to obtain a synthetic benchmark that holds fixed the level of structural transformation reached at the end of the sample period. The choice of criteria is constrained by the availability of indicators that are comparable across countries. Our additional criteria are labor productivity, the percentage of rural population, cereal crop yield, and an indicator for agricultural mechanization (the number of tractors per arable land surface), all averaged over 1975–1985. The exact definition and an indication of the source for these variables is in the appendix. For this second benchmark, the vectors $\mathbf{Z}_j$ and $\mathbf{Z}^\mathbf{s}$ contain $K = 15$ characteristics. The second synthetic benchmark increases the weight of Latin American countries and reduces the weights of Portugal and Greece. It is a mixture of Mexico (36.9%), Uruguay (35.4%), Portugal (12.2%), Greece (7.2%), Belgium (7.2%), and Brazil (1.0%).

The two synthetic benchmarks align well with the evolution of Spain's relative border thickness in the post-Franco period, as is apparent from Figure 4. They differ in the period before the

Figure 4: Synthetic Spain: relative border thickness



Notes: The figure plots the estimated relative thickness of the borders of Spain and of two synthetic benchmarks for Spain. Relative thickness is measured as the percent deviation from the border effect of the world excluding Europe and the Americas. The estimation uses the specification in (3) augmented by introducing region-specific border dummy variables for each country in Europe and on the American continent. These additional dummy variables are constructed using the definition in (2) replacing "Spain" with the name of each country. The two synthetic benchmarks are constructed from individual country data using the weights in Table 2.

Stabilization Plan of 1959, but are very close to each other after 1960.

6.3 The cost of a closed economy

In Table 1, we report the average welfare loss stemming from Spain's border thickness over various periods of interest and according to different benchmarks used for comparison. The welfare costs are expressed in consumption equivalent terms. Results vary depending on which country is used as a benchmark. The cumulative welfare cost over the period 1948–1975 ranges from 19.2%, if Greece is used as a benchmark, to 111.8%, if the comparison is made with Italy. The synthetic benchmarks, which converge to Spain's relative border thickness in the period 1976–1985 by design, are on the lower part of this range. Nevertheless, they point to cumulative losses of welfare of between a quarter and two-fifths of a full year of consumption.

Table 1: Welfare cost of Spain's relative border thickness

	1948–1952	1953–1959	1960–1975	1976–1985	Total 1948–1975
Greece	-0.8	-1.2	-0.4	-0.2	-19.2
Portugal	-2.2	-1.7	-1.1	-0.3	-40.8
Italy	-3.9	-3.3	-4.3	-5.5	-111.8
France	-3.3	-2.3	-2.1	-2.6	-66.3
Synthetic Spain [1]	-1.4	-1.3	-0.5	0.0	-23.9
Synthetic Spain [2]	-3.6	-2.3	-0.4	-0.0	-41.0

Notes: The table shows Spain's welfare loss owing to its relative border thickness, using different countries as a comparison. Results compare Spain's welfare to that it would have had if Spain's border thickness had been set at the level of another country or synthetic benchmark. Negative numbers indicate that Spain's actual welfare is lower than in the counterfactual case. We express welfare losses as percentage points of a full year's consumption. The first four columns show yearly averages for each period of interest, and the last column reports the cumulative welfare loss over the years 1948–1975.

As expected from the difference of the border thickness estimates depicted in Figure 4, the largest disagreement between computations using the synthetic benchmarks is in the first period. Through the lens of the model, the average yearly welfare cost in the period 1948–1952 ranges between 1.4% and an extremely high 3.6% of consumption, depending on the synthetic benchmark that is used. For the period after the Stabilization Plan, the calculations using both synthetic benchmarks roughly coincide, and amount to between 0.4% and 0.5% of consumption. These numbers imply that the slow opening of the economy in the 16 years following the Stabilization Plan had a welfare cost of between $0.4\% \times 16 = 6.4\%$ and $0.5\% \times 16 = 8.0\%$ of consumption.

To put the welfare costs into perspective it is useful to compare them with the welfare gains or losses from trade estimated for Spain in more recent times using similar models. Mayer et al. (2019) estimate that the welfare gains for Spain of belonging to the European Union amount to between 0.9% and 1.3% of consumption or real income in a static trade model similar to ours whereas Felbermayr et al. (2018) estimate that the collapse of the European single market would amount to a welfare loss of 2.6% for Spain. Felbermayr et al. (2015) use the ACR formula with a trade elasticity $\epsilon = 5$ and report that a move to complete autarky in the year 2008 would have reduced Spain's welfare by 3.1%. Redoing their calculation for a trade elasticity $\epsilon = 4$, as the one we use, raises the welfare loss to 3.9%. These are large welfare losses calculated for large changes in trade policy. On the other end of the range of estimates, and focusing on less extreme changes in policy, Felbermayr et al. (2020) calculate that current membership in GATT/WTO increases Spain's welfare by 0.4%, and Baier et al. (2019) estimate that the positive impact on welfare of signing the Transatlantic Trade and Investment Partnership (TTIP) would have been around 0.1% for Spain. Compared to these costs, the welfare cost of the Spain's closed economy during the Franco regime were substantial.

7 Concluding remarks

Our estimates based on historical trade flows imply a clear pattern of a reduction of Spain's border thickness over the period 1948–1975, in particular after the move from quotas to tariffs and the convertibility of the peseta in 1959. However, Spain's borders remained thicker than those of any other country in Western Europe for the whole period and the relatively high impediments to international trade implied non-negligible negative effects on consumer welfare.

Our quantification of Spain's border thickness agrees with the historical evolution of economic and trade policy in the 1950s and 1960s. It confirms the generally negative views espoused by economic historians on economic policies in the early years of this period, and suggests that the incipient trade liberalization for certain goods in the 1950s did not spill over into aggregate trade in any significant way.

Our results highlight a negative aspect of economic policy after 1959 that had previously received less attention. Our estimates show that the Stabilization Plan and subsequent reforms in the 1960s and 1970s did little to reduce the distance to Spain's European peers, particularly those under democratic regimes, such as Italy and France. By putting the focus on consumption, as done by the welfare criterion in standard trade models such as the Armington model, we quantify the costs in terms of consumer welfare. We conclude that the trade policy, which restricted consumer choice over the whole period, led to a considerable loss of consumer welfare, and estimate that accumulated welfare costs over the period 1948–1975 exceeded 20% of a year's total consumption.

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Appendices

A Identification

The estimating equation can be written as

$$X_{ijt} = \exp(\Lambda_{ijt}) + \varepsilon_{ijt},$$

where

$$\Lambda_{ijt} = \gamma_t I(i \neq j) + \theta_t I(i \neq j)[I(i = \text{Spain}) + I(j = \text{Spain})] + \phi_{it} + \psi_{jt} + \boldsymbol{\beta}^T \mathbf{z}_{ij}$$

What exactly does θ identify? The answer is that it identifies the average of outward and inward border thickness. We focus on the case $\boldsymbol{\beta}^T \mathbf{z}_{ij} = 0$ and on a single date t, and remove the subscript t for simplicity. The estimating equation then becomes

$$\begin{aligned}
\Lambda_{ij} &= \gamma I(i \neq j) + \theta I(i \neq j)[I(i = \text{Spain}) + I(j = \text{Spain})] + \phi_i + \psi_j \\
&= \gamma I(i \neq j) + \theta[1 - I(i = j)][I(i = \text{Spain}) + I(j = \text{Spain})] + \phi_i + \psi_j \\
&= \gamma I(i \neq j) - 2\theta I(i = j = \text{Spain}) + [\phi_i + \theta I(i = \text{Spain})] + [\psi_j + \theta I(j = \text{Spain})] \qquad (12)
\end{aligned}$$

Suppose that we wanted to distinguish between inward and outward border thickness and wished to estimate a specification of the form

$$\Lambda'_{ij} = \gamma' I(i \neq j) + \theta^x I(i \neq j) I(i = \text{Spain}) + \theta^m I(i \neq j) I(j = \text{Spain}) + \phi'_i + \psi'_j.$$

We are going to show that only the average $\theta = (\theta^x + \theta^m)/2$ is identified in this case.

$$\begin{aligned}
\Lambda'_{ij} &= \gamma' I(i \neq j) + \theta^x I(i \neq j) I(i = \text{Spain}) + \theta^m I(i \neq j) I(j = \text{Spain}) + \phi'_i + \psi'_j \\
&= \gamma' I(i \neq j) + \theta^x [1 - I(i = j)] I(i = \text{Spain}) + \theta^m [1 - I(i = j)] I(j = \text{Spain}) + \phi'_i + \psi'_j \\
&= \gamma' I(i \neq j) - \theta^x I(i = j) I(i = \text{Spain}) - \theta^m I(i = j) I(j = \text{Spain}) + \phi''_i + \psi''_j \\
&= \gamma' I(i \neq j) - (\theta^x + \theta^m) I(i = j = \text{Spain}) + \phi''_i + \psi''_j, \qquad (13)
\end{aligned}$$

where $\phi''_i = \phi'_i + \theta^x$ if i is Spain, and $\phi''_i = \phi'_i$ otherwise, and $\psi''_j = \psi'_j + \theta^m$ if j is Spain, and $\psi''_j = \psi'_j$ otherwise. The parameters, θ^x and θ^m cannot be identified separately because (13) delivers only three estimates for four unknowns (the unknowns are the two parameters of interest and the two fixed effects for Spain). Moreover, the comparison of the expressions in (12) and (13) shows that $\theta = (\theta^x + \theta^m)/2$.

B Theoretical model

This section describes the methodology used in our general equilibrium computations. Neither the model nor the solution method are novel; they are part of the toolkit commonly used by trade economists. The model is a standard Armington model (Anderson and van Wincoop, 2003) with exogenous trade deficits (Dekle et al., 2007). The algorithm for comparative statics uses the methods of Dekle et al. (2007) and our description is based on the steps described by Head and Mayer (2014) and Baier et al. (2019).

B.1 Trade model

Preferences and demand

Consumers in country j consume $q_{ij} \geq 0$ units of the product produced in country i. Utility exhibits a constant elasticity of substitution (CES), $\sigma > 1$, over all the country-specific products:

$$U_j = \left(\sum_i \alpha_{ij}^{\frac{1}{\sigma}} q_{ij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{14}$$

The coefficient $\alpha_{ij} \geq 0$ is a utility shifter that can be thought of as an index of the quality of country i's product. The price paid for good q_{ij} is p_{ij}. Denote total expenditure by consumers in country j by E_j. Utility maximization subject to the budget constraint

$$\sum_i p_{ij} q_{ij} = E_j \tag{15}$$

leads to the well-known CES demand function:

$$q_{ij} = \alpha_{ij} p_{ij}^{-\sigma} E_j P_j^{\sigma-1}, \quad \forall (i,j), \tag{16}$$

where

$$P_j \equiv \left(\sum_i \alpha_{ij} p_{ij}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \tag{17}$$

is the Dixit-Stiglitz price index. Using optimal demands (16) in the utility function (14), it can be shown that indirect utility depends only on expenditure E_j and the price index P_j:

$$V(E_j, P_j) = \frac{E_j}{P_j}. \tag{18}$$

Technology and trade costs

Each country i produces a single differentiated good using only labor L_i. Labor is inelastically supplied, immobile across countries, and its factor price is the wage rate w_i. The production technology is $f(L_i) = A_i L_i$, where $A_i > 0$ is a productivity parameter specific to country i. We assume perfect competition, so that the factory price in the country were a good is produced is equal to the marginal cost:

$$p_i = \frac{w_i}{A_i}, \quad \forall i. \tag{19}$$

Shipping this good to another country incurs in so-called iceberg costs (the good melts while it is being transported). It is necessary to ship $\tau_{ij} q_{ij}$ in country i so that q_{ij} arrives at its destination in country j. Trade costs $\tau_{ij} \geq 1$ are specific to each country pair. Arbitrage in international markets then implies that the price paid for the good of country i country j is

$$p_{ij} = \tau_{ij} p_i = \tau_{ij} \frac{w_i}{A_i}, \quad \forall (i,j). \tag{20}$$

Because of zero profits, a country's total income equals the value of output and also the total wage bill:

$$Y_i = p_i A_i L_i = w_i L_i, \quad \forall i. \tag{21}$$

Excess demands and market clearing

The trade deficit (or excess demand) of an arbitrary country ℓ equals the value of its imports minus the value of its exports, or the difference between its income and expenditure:

$$\begin{aligned} D_\ell &\equiv \sum_{i \neq \ell} p_{i\ell} q_{i\ell} - \sum_{j \neq \ell} p_{\ell j} q_{\ell j} \\ &= (E_\ell - p_{\ell\ell} q_{\ell\ell}) - (Y_\ell - p_{\ell\ell} q_{\ell\ell}) \\ &= E_\ell - Y_\ell \end{aligned} \tag{22}$$

Naturally, the sum of trade deficits over all countries must be zero in equilibrium:

$$\sum_i D_i = \sum_i (E_i - Y_i) = 0. \tag{23}$$

Market clearing in the goods market implies that the supply of a country's good is equal to total demand, including the resource cost of transporting goods to different destinations:

$$A_i L_i = \sum_j \frac{1}{\tau_{ij}} q_{ij}, \quad \forall i. \tag{24}$$

Definition of an equilibrium

Given preference parameters $\{\alpha_{ij}\}$ and σ, productivities $\{A_i\}$, labor endowments $\{L_i\}$, and exogenous trade deficits $\{D_i\}$ that satisfy the restriction in (23), an equilibrium is defined as collection of allocations $\{q_{ij}\}$, goods prices in the destination country $\{p_{ij}\}$, and local wages $\{w_i\}$, such that

1. consumer demands are optimal given budget constraints (15), as in (16) with the definition in (17),
2. local prices equal local marginal costs and simultaneously international prices satisfy a no-arbitrage condition, as in (20),
3. and goods markets clear, as in (24).

B.2 Comparative statics

For given exogenous variables, equilibrium allocations and prices solve a system of equations. In general, this system needs to be solved numerically after specifying all exogenous variables.

The characterization of comparative statics removes the need to specify all exogenous variables. Using the "hat algebra" of Dekle et al. (2007), comparative statics can be obtained numerically by solving a system of equations that depends only on the elasticity of substitution σ, the exogenous change assumed for trade deficits, and on observed trade flows. Variables with hats indicate the ratio of the value of a variable in a counterfactual equilibrium (denoted with primes) and an observed equilibrium (without primes): $\hat{x} = x'/x$ for any variable x.

Algorithm

The inputs for the comparative statics exercise are the full matrix of observed trade flows $\{X_{ij}\}$, a value for the parameter σ, and a matrix of exogenous changes in trade costs $\{\hat{\tau}_{ij}\}$. The steps for the comparative statics exercise are the following:

1. Calculate $Y_i = \sum_j X_{ij}$ for all i and $E_j = \sum_i X_{ij}$ for all j.
2. Calculate trade shares $\lambda_{ij} = \frac{X_{ij}}{E_j}$ for all combinations of i and j.
3. Solve for wage changes $\hat{w}_i$ in the system of equations

$$\hat{w}_i = \frac{1}{Y_i} \sum_j \frac{\lambda_{ij} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}}{\sum_k \lambda_{kj} \left(\hat{w}_k \hat{\tau}_{kj}\right)^{1-\sigma}} \hat{w}_j E_j, \quad \forall i,$$

   with the normalization $\sum_i \hat{w}_i = 0$.
4. Calculate the change in trade shares as

$$\hat{\lambda}_{ij} = \frac{\left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}}{\sum_k \lambda_{kj} \left(\hat{w}_k \hat{\tau}_{kj}\right)^{1-\sigma}},$$

   for all combinations of i and j.
5. For any particular country j, calculate the change in welfare using the formula

$$\hat{V}_j = \hat{\lambda}_{jj}^{-\frac{1}{\sigma-1}}.$$

Derivation of the steps in the comparative statics algorithm

Steps 1 and 2: nothing to show, these steps consist only of definitions.

Step 4: In equilibrium, the value of trade is flowing from country i to country j is

$$\begin{aligned} X_{ij} &\equiv p_{ij} q_{ij} \\ &= \alpha_{ij} \frac{p_{ij}^{1-\sigma}}{P_j^{1-\sigma}} E_j \\ &= \alpha_{ij} \left(\frac{w_i}{A_i} \frac{\tau_{ij}}{P_j} \right)^{1-\sigma} E_j, \end{aligned} \tag{25}$$

where the second line uses the optimal demand for q_{ij} in (16) and the third line uses (20), which combines firm optimization with the no-arbitrage condition. From this equation, the trade elasticity is

$$\epsilon \equiv -\frac{\partial \ln X_{ij}}{\partial \ln \tau_{ij}} = \sigma - 1 > 0. \tag{26}$$

Another way of writing (25) is dividing both sides by E_j and defining the share of trade out of expenditure:

$$\lambda_{ij} \equiv \frac{X_{ij}}{E_j} = \alpha_{ij} \left(\frac{w_i}{A_i} \frac{\tau_{ij}}{P_j} \right)^{1-\sigma}. \tag{27}$$

Substituting the price index:

$$\lambda_{ij} = \frac{\alpha_{ij} \left(\frac{w_i \tau_{ij}}{A_i} \right)^{1-\sigma}}{\sum_k \alpha_{kj} \left(\frac{w_k \tau_{kj}}{A_k} \right)^{1-\sigma}}. \tag{28}$$

In equilibrium, counterfactual trade shares are equal to

$$\begin{aligned} \lambda'_{ij} &= \frac{\alpha_{ij} \left(\frac{w'_i \tau'_{ij}}{A_i} \right)^{1-\sigma}}{\sum_k \alpha_{kj} \left(\frac{w'_k \tau'_{kj}}{A_k} \right)^{1-\sigma}} \\ &= \frac{\alpha_{ij} \left(\frac{w_i \tau_{ij}}{A_i} \right)^{1-\sigma} (\hat{w}_i \hat{\tau}_{ij})^{1-\sigma}}{\sum_k \alpha_{kj} \left(\frac{w_k \tau_{kj}}{A_k} \right)^{1-\sigma} (\hat{w}_k \hat{\tau}_{kj})^{1-\sigma}} \\ &= \frac{\lambda_{ij} (\hat{w}_i \hat{\tau}_{ij})^{1-\sigma}}{\sum_k \lambda_{kj} (\hat{w}_k \hat{\tau}_{kj})^{1-\sigma}}. \end{aligned} \tag{29}$$

The second equality uses $w'_i = \hat{w}_i w_i$ and $w'_i = \hat{w}_i w_i$, and the third equality divides numerator and denominator by $\sum_\ell \alpha_{\ell j} (\frac{w_\ell \tau_{\ell j}}{A_\ell})^{1-\sigma}$ to reconstruct the trade shares. Dividing both sides by λ_{ij} leads to

$$\hat{\lambda}_{ij} = \frac{(\hat{w}_i \hat{\tau}_{ij})^{1-\sigma}}{\sum_k \lambda_{kj} (\hat{w}_k \hat{\tau}_{kj})^{1-\sigma}}. \tag{30}$$

Step 3: Notice that in equilibrium, the following relationships hold:

$$Y_i = p_i A_i L_i = p_i \sum_j \frac{1}{\tau_{ij}} q_{ij} \sum_j p_{ij} q_{ij} = \sum_j X_{ij} = \sum_j \lambda_{ij} E_j \tag{31}$$

The first equality is from the definition of a country's income in (21), the second imposes the market clearing condition in (24), the third uses the no-arbitrage condition in (20). The last two equalities use the definition of trade flows and of trade shares, respectively. Because these relationships hold in any equilibrium, they also hold at the counterfactual equilibrium, and

$$Y'_i = \hat{Y}_i Y_i = \sum_j \lambda'_{ij} E'_j = \sum_j \hat{\lambda}_{ij} \lambda_{ij} E'_j \tag{32}$$

Rearranging, using the definition of trade deficits, and substituting from (30),

$$\hat{Y}_i = \frac{1}{Y_i} \sum_j \frac{\lambda_{ij} (\hat{w}_i \hat{\tau}_{ij})^{1-\sigma}}{\sum_k \lambda_{kj} (\hat{w}_k \hat{\tau}_{kj})^{1-\sigma}} (\hat{Y}_j Y_j + \hat{D}_j D_j) \tag{33}$$

Notice that from $Y_i = w_i L_i$, it follows that $\hat{Y}_i = \hat{w}_i$. Using this result and the definition of trade deficits in the previous equation,

$$\hat{w}_i = \frac{1}{Y_i} \sum_j \frac{\lambda_{ij} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}}{\sum_k \lambda_{kj} \left(\hat{w}_k \hat{\tau}_{kj}\right)^{1-\sigma}} [\hat{w}_j Y_j + \hat{D}_j (E_j - Y_j)], \quad \forall i. \tag{34}$$

Assumption 1 *Trade deficits are a constant fraction of output:* $\hat{D}_i = \hat{Y}_i$.

With this assumption,

$$\hat{w}_i = \frac{1}{Y_i} \sum_j \frac{\lambda_{ij} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}}{\sum_k \lambda_{kj} \left(\hat{w}_k \hat{\tau}_{kj}\right)^{1-\sigma}} \hat{w}_j E_j, \quad \forall i. \tag{35}$$

This equation if homogeneous of degree zero (only changes in relative prices are determined). Therefore, a normalization is required for the numerical solution. As is usual in the recent literature, we normalize wages to maintain world income constant across scenarios:

$$\sum_i \hat{Y}_i = \sum_i \hat{w}_i = 0. \tag{36}$$

Step 5: The formula in this last step does not follow directly from the results by Arkolakis et al. (2012), because one of their assumption (balanced trade) is not satisfied in this model. However, the usual ACR formula also holds in this version of the model. Welfare is obtained from the indirect utility function

$$\hat{V}_j = \frac{\hat{E}_j}{\hat{P}_j} = \frac{\hat{w}_j}{\hat{P}_j} \tag{37}$$

To obtain $\hat{P}_j$, notice that

$$\begin{aligned}
(P_j')^{1-\sigma} &= \sum_i \alpha_{ij} \left(\frac{w_i'}{A_i} \tau_{ij}'\right)^{1-\sigma} \\
&= \sum_i \alpha_{ij} \left(\frac{w_i}{A_i} \tau_{ij}\right)^{1-\sigma} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma} \\
&= P_j^{1-\sigma} \sum_i \lambda_{ij} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}
\end{aligned} \tag{38}$$

Therefore,

$$\hat{P}_j^{1-\sigma} = \sum_i \lambda_{ij} \left(\hat{w}_i \hat{\tau}_{ij}\right)^{1-\sigma}. \tag{39}$$

From (30), the change in the domestic trade share is

$$\hat{\lambda}_{jj} = \frac{\left(\hat{w}_j \hat{\tau}_{jj}\right)^{1-\sigma}}{\sum_k \lambda_{kj} \left(\hat{w}_k \hat{\tau}_{kj}\right)^{1-\sigma}} = \frac{\hat{w}_j^{1-\sigma}}{\hat{P}_j^{1-\sigma}}, \tag{40}$$

where the second equality follows from $\hat{\tau}_{jj} = 1$. Rearranging,

$$\hat{P}_j = \hat{w}_j \hat{\lambda}_{jj}^{\frac{1}{\sigma-1}}. \tag{41}$$

Therefore, the change in welfare is

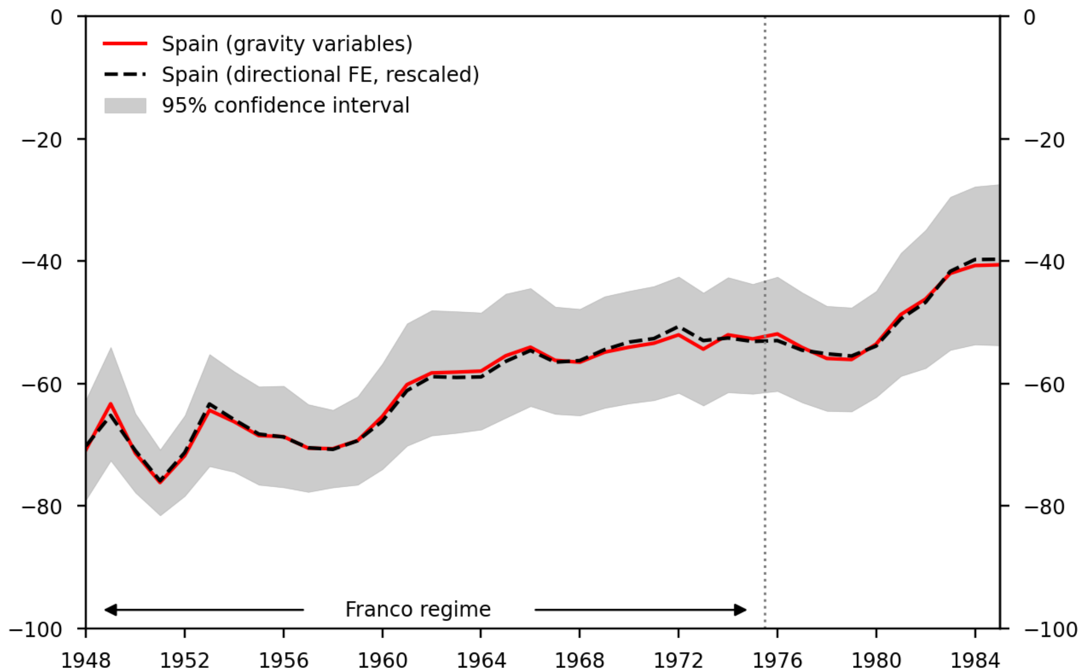
$$\hat{V}_j = \frac{\hat{E}_j}{\hat{P}_j} = \frac{\hat{w}_j}{\hat{P}_j} = \hat{\lambda}_{jj}^{-\frac{1}{\sigma-1}} = \hat{\lambda}_{jj}^{-\frac{1}{\epsilon}}, \tag{42}$$

as in the ACR formula.

C Empirical appendix

C.1 Robustness: directional pair fixed effects

Figure 5: Spain's relative border thickness: robustness



Notes: The figure plots the estimated relative thickness of Spain's borders measured as the percent deviation of Spain's border effect from the border effect of a typical country. The estimation with gravity variables (solid line) uses the specification in (3). The dashed line is an estimation in which gravity variables have been replaced with directional pair fixed effects and coefficients have been rescaled so that their average coincides with the average of the baseline specification. Marginal effects are constructed from estimates $\hat{\theta}_t$ using the transformation $100 \times [\exp(\hat{\theta}_t) - 1]$. The 95% confidence interval shown for the marginal effects of the specification with gravity variables is calculated using the delta method.

C.2 Synthetic benchmarks

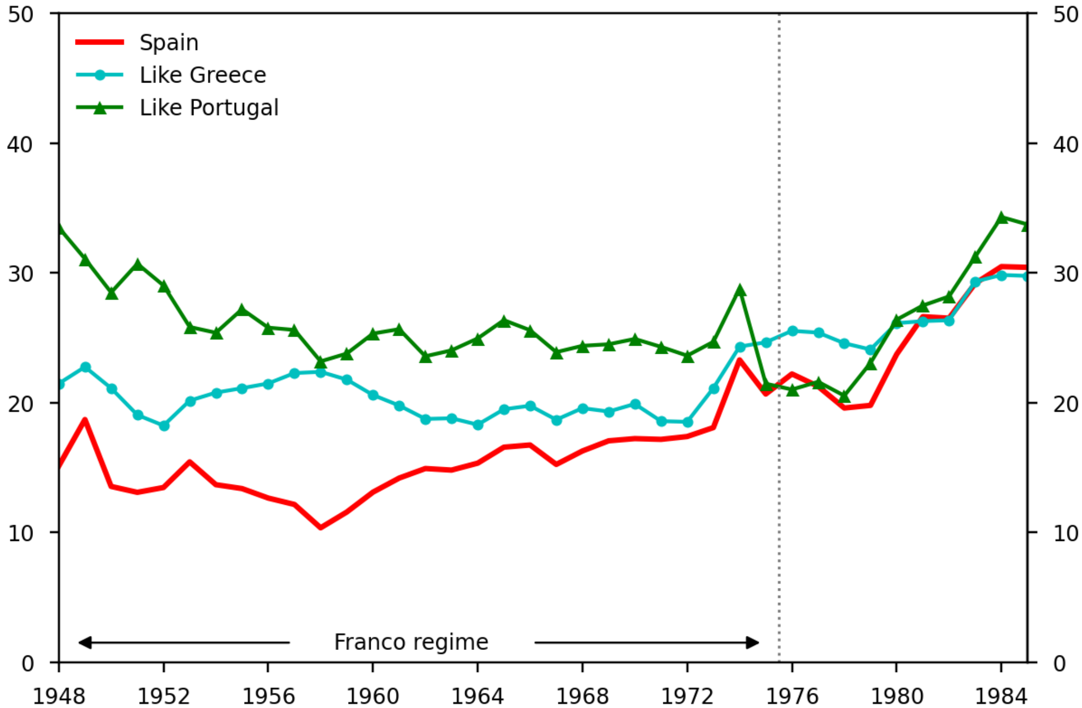
Table 2: Synthetic benchmark weights

	Synthetic Spain [1]	Synthetic Spain [2]
Argentina		
Austria		
Belgium		7.2%
Bulgaria	11.8%	
Bolivia		
Brazil		1.0%
Canada		
Switzerland		
Chile		
Colombia		
Denmark	1.5%	
Dominican Republic		
Ecuador		
Finland		
France		
United Kingdom		
Greece	23.3%	7.2%
Honduras		
Haiti		
Hungary		
Ireland		
Italy		
Mexico	27.2%	36.9%
Nicaragua		
Netherlands	1.4%	
Norway		
Panama		
Peru		
Poland		
Portugal	34.8%	12.2%
Paraguay		
Romania		
Sweden		
Uruguay		35.4%
United States		

Notes: optimal weights derived for each synthetic benchmark using the methodology described in the main text.

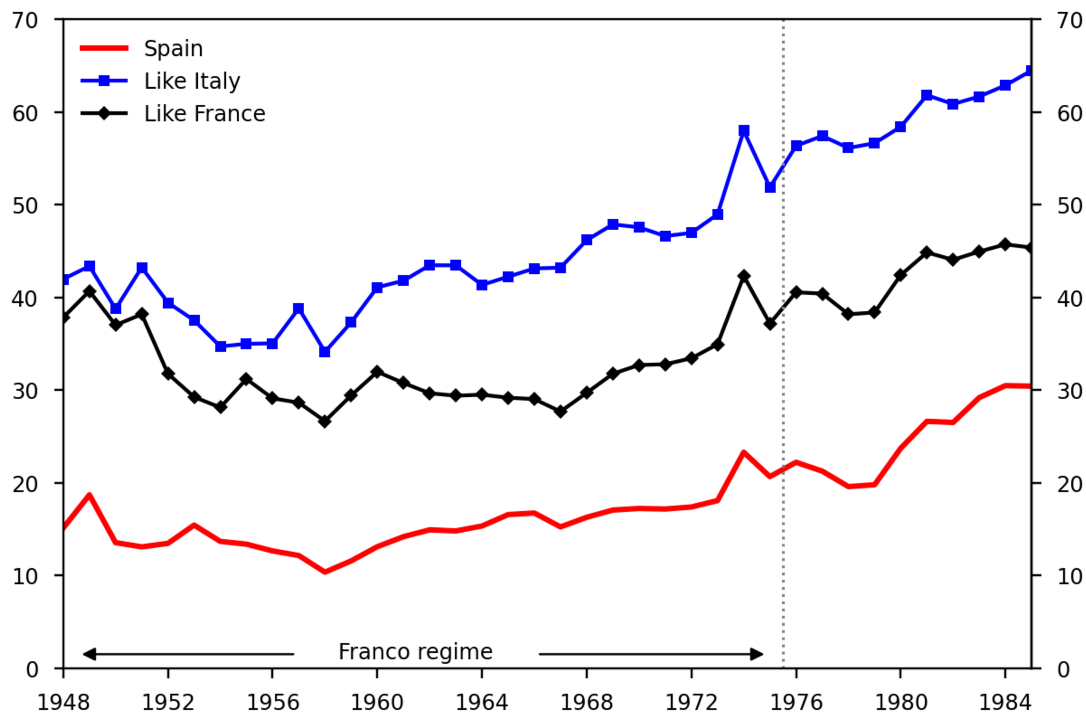
C.3 Simulation results

Figure 6: Spain's simulated trade openness using Greece and Portugal as counterfactuals



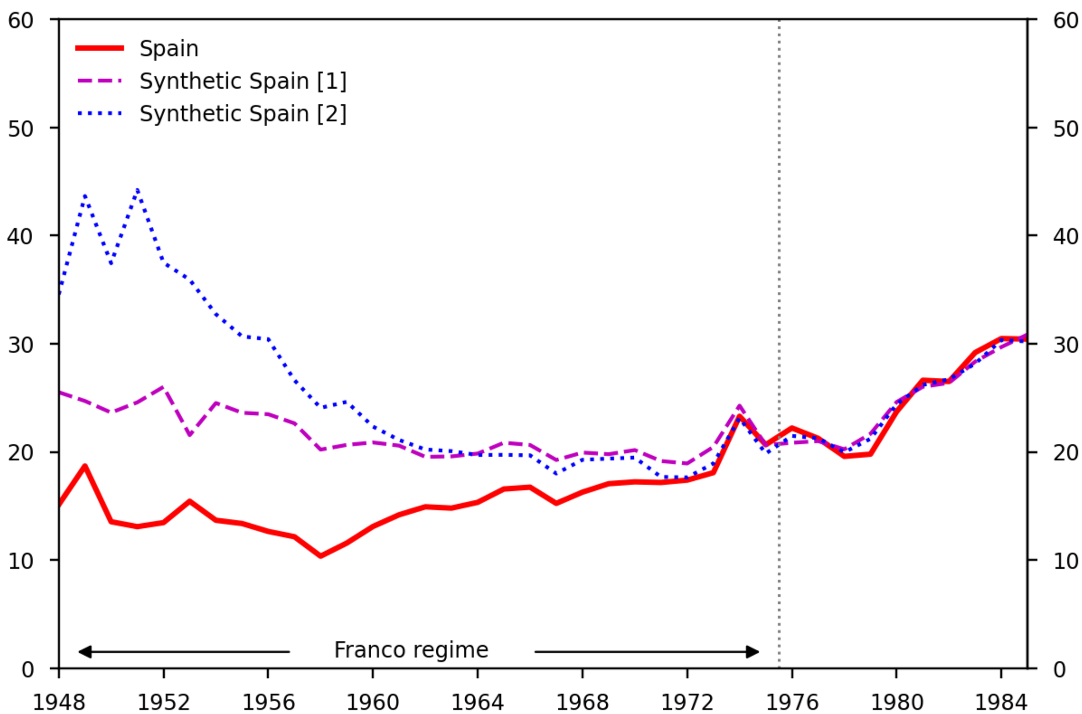
Notes: The figure plots Spain's trade openness (export plus imports as percent of GDP) compared to counterfactual exercises in which its border thickness has been set to that of Greece or Portugal.

Figure 7: Spain's simulated trade openness using France and Italy as counterfactuals



Notes: The figure plots Spain's trade openness (export plus imports as percent of GDP) compared to counterfactual exercises in which its border thickness has been set to that of France or Italy.

Figure 8: Spain's simulated trade openness using synthetic benchmarks as counterfactuals



Notes: The figure plots Spain's trade openness (export plus imports as percent of GDP) compared to counterfactual exercises in which its border thickness has been set to that of the synthetic benchmarks.

D Data appendix

D.1 Variable definitions

Used for gravity regressions and construction of domestic trade flows:

Variable	Name in data source and transformation	Data source
Bilateral trade flows	FLOW	Tradhist v.4
Gross domestic product	GDP_o, GDP_d	Tradhist v.4
Bilateral distance	ln(Dist_coord)	Tradhist v.4
Colonial relationship	Evercol	Tradhist v.4
Contiguity	Contig	Tradhist v.4
Common language	Comlang	Tradhist v.4

Used for synthetic benchmarks:

Variable	Name in data source and transformation	Data source
Overall trade openness	(csh_x + csh_m)/2	Pwt v.10.0
Labor productivity	rgdp_o/emp	Pwt v.10.0
Rural population share	SP.RUR.TOTL.ZS	Wdi
Cereal crop yield	AG.YLD.CREL.KG	Wdi
Tractors per arable land	AG.LND.TRAC.ZS	Wdi

D.2 Country group definitions

All country codes are defined as in the tradhist database.

Spain: ESP.

Western Europe: AUT, BEL, CHE, DEU, DNK, FIN, FRA, FRO, GBR, GRL, IRL, ISL, LUX, NLD, NOR, SWE, WDEU.

Southern Europe: AND, CYP, GIB, GRC, ITA, MLT, PRT, TRIEST.

Eastern Europe: ALB, BGR, CZSK, EDEU, HUN, LVA, POL, ROM, USSR, YUG.

Americas: ARG, BOL, BRA, CHL, COL, CRI, CUB, DOM, ECU, GTM, HND, HTI, JAM, MEX, NIC, PAN, PER, PRY, URY, USA, VEN.