A gravity criterium for discriminating traditional protection measures

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Abstract

The case of Spain in the first globalization illustrates how the gravity equation, as a tool from which to derive a comprehensive measure of trade costs, can be used to test the soundness of alternative direct measures of specific costs.

1. Introduction

Following the flood of works that provided new theoreticalfoundations for the gravity equation (Feenstra, 2002, 2004; Anderson and van Wincoop, 2003; Baldwin and Taglioni, 2006; Novy, 2007), a number of studies have used this equation to derive a comprehensive measure of trade cost barriers (Jacks et al., 2006, 2008). The procedure consists of calculating bilateral barriers as the difference between a country's actual trade and the flow predicted, basically, by the evolution of bilateral GDPs. The measure thus calculated has the advantage of combining the deterrent effect of custom tariffs and transport costs with that of the frictions related to institutional and Informational barriers.

Our goal is to show how the measure derived from the gravity equation, as well as providing comprehensive bilateral measures of trade costs, is also useful to test the soundness of alternative direct measures of specific costs. As an example, we consider the case of Spain in the first wave of globalization (1870–1913), a country and period for which, given the controversy about the effects of protectionism on growth, there is a wide range of alternative measures of tariff barriers.

The remainder of the paper is organized as follows. Section 2 summarizes the procedure followed to calculate our measure of trade costs barriers. Section 3 presents the direct measures of barriers, paying special attention to the alternative indexes of tariff protection. Finally, Section 4 tests for the sensitivity of our derived measure to the available potential determinants of trade and concludes.

2. The procedure

To derive a comprehensive measure of trade costs, we start from the Anderson and van Wincoop (2003) proposal of a gravity equation that, applied to the bilateral Spanish trade, can be expressed as:

$$X_{js} = M_{sj} = \frac{Y_j \cdot Y_s}{Y^W}\left(\frac{t_{js}}{P_j \cdot P_s}\right)^{1-\sigma} \qquad (1)$$

where Xjs (Msj) denotes exports (imports) from country j to Spain (to Spain from j); Yj and Ys represent the respective national GDPs; Yw is the total world income and σ the elasticity of substitution between products. As regards trade barriers, tjs is the bilateral trade cost factor (one plus the so-called tariff equivalent) and Pj and Ps denote j and Spain's multilateral resistance variables.1 Then, by proxying multilateral resistance by the use of market potential variables as in Novy (2007), we derive the trade cost tariff equivalent as:

$$Z_{js} = 1 - \left(\frac{M_{sj}}{Y_j^* \cdot Y_s^*}\right)^{1-\sigma} \qquad (2)$$

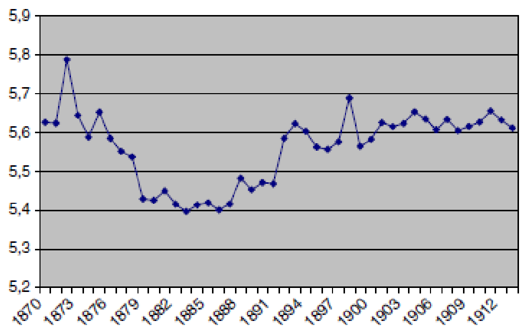

Fig. 1. Spain, France, Germany, UK and USA average trade cost tariff equivalent.

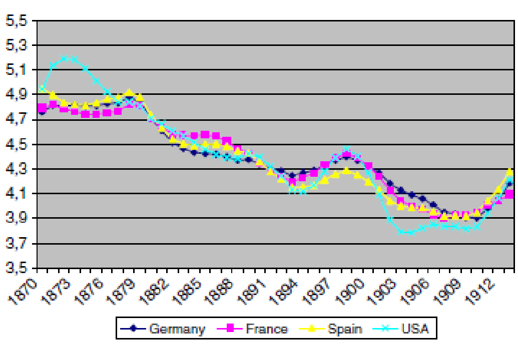

Fig. 2. Indexes of bilateral freight rates with the UK.

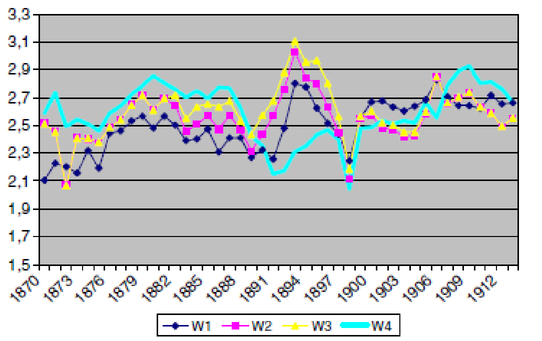

Fig. 3. Trade-weighted custom tariff averages.

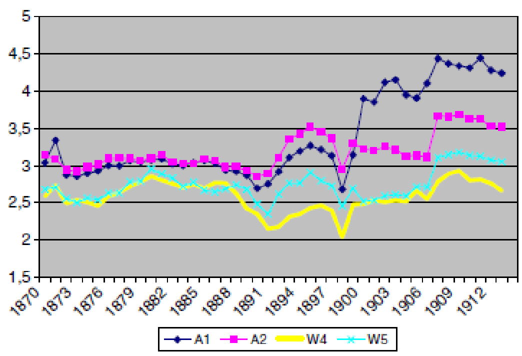

Fig. 4. Simple and weighted custom tariff averages.

where Yj* and Ys* denote the j's and Spain's GDPs, after discounting their respective total export levels.2

The availability of data reduces the sample to seventeen countries (Continental Europe plus the UK, Australia, Canada, Japan, New Zealand, Uruguay and the USA), which averaged 75% of the total imports over 1870–1913. Bilateral imports come from the Spanish Foreign Trade Statistics and total exports from Mitchell (2003a,b,c). All these figures have been converted to dollars by applying the exchange rates in the Global Financial Data site (http://www. globalfindata.com) and then passed to 1990 dollars with the US deflator of Taylor (2002). National GDPs (expressed in 1990 Geary–Khamis dollars) come from Maddison (1995, 2001), except those for Uruguay and Spain, that come from Bertola et al. (manuscript) and Prados (manuscript), respectively. With all these data, and hypothesizing an elasticity of 5, we have calculated the bilateral Spanish cost trade tariff equivalents on which to regress different indexes of protection.3 In Fig. 1, we present the resulting average index of bilateral trade cost for Spain's main partners.

3. The determinants of trade

In order to test for the sensitivity of our calculated trade cost equivalent tariff to direct measures of trade barriers, we propose to estimate the following expression:

$$Z_{js} = \beta_{1mcjs} + \beta_{2rwcs} + \beta_{3ts} + \varepsilon_{js} \qquad (3)$$

where all variables are in logs; mcjs is a representative measure of the maritime freight rate between Spain and country j; rwcs denotes the Spanish railway freight rate; and ts is the Spanish ad valorem tariff on imports.

Data about maritime shipping costs reflect an overall declining trend during the period 1870–1913, as shown by Mohammed and Williamson (2004) in their real global freight rate index. The same occurs according to the indexes of country-pair specific freight rates offered in Jacks and Pendakur (2010). These authors construct indexes between the UK and 21 other countries for 1870–1913, a selection of which is shown in Fig. 2. We use this freight rate series to proxy the evolution of bilateral Spanish shipping costs. Furthermore, there is a direct measure of overland transport costs for Spain. Tariffs are available in pesetas per ton and kilometre for the main Spanish railroad company (the MZA company) and we have deflated the resulting series by applying the tradable goods deflator of Prados de la Escosura (2003).

As regards tariff barriers, in Fig. 3, we show different measures of trade-weighted nominal protection. The trajectory of W1 corresponds to the ratio of tariff revenues on the value of total imports as registered in the official Spanish Foreign Trade Statistics. It is worth remarking that in the Spanish case, the unreliability of official import unit values introduces significant bias into the calculation of the ad valorem rates of protection. For this reason, we also work with measures such as W2 and W3 that take into account the falsity of the import unit values in the official statistics.W2is calculated by dividing the tariff revenue by the corrected import values in Prados de la Escosura (1986). W3 comes from Tena (2006), who adds the surcharges on sugar imports to the import revenues. We have modified these three series to take into account the payment of Spanish tariffs in gold from 1906 on, which meant an appreciable surcharge on duties.4 Payment in gold is also taken into account in the trade-weighted measure W4 constructed by Tirado (1994). In this case, the official values are also corrected but, instead of considering all products registered in the Spanish Trade Statistics over 1870–1913, the author uses an unchangeable selection of highly representative goods over the period. Therefore, the index has the advantage of avoiding the risk that changes in the aggregate measure might simply be reflecting changes in the goods composition of trade. However, as is well-known, trade-weighted averages endogenize the constraint effect of a tariff increase on trade and, consequently, a bias of undervaluation is consubstantial to these measures. The higher the tariff applied to a certain good, the lower its imports and the lower the weight of the highest taxed goods in the calculation of the aggregate level of protection. For this reason, it is important to have, apart from trade-weighted averages, arithmetic simple averages. The arithmetic simple average, S1, shown in Fig. 4 along with W4, is offered in Tirado (1994), both of them for the same sample of representative goods. It is clear how the simple average, as expected, reaches higher values than their corresponding weighted rates. The same occurs if we compare W5 to S2, where W5 is the weighted average and S2 the simple average for the industrial goods included in W4 and S1, respectively.

Table 1
Determinants of the trade cost tariff equivalent.

	Weighted averages					Simple averages	
	W1	W2	W3	W4	W5	S1	S2
Maritime costs	0.29	0.22	0.16	0.33	0.41	0.92	0.50
	(1.95)	(1.55)	(1.16)	(2.18)	(2.51)	(4.38)	(2.88)
Railway costs	1.16	0.15	0.16	0.23	0.49	0.20	0.15
	(2.64)	(2.56)	(2.58)	(2.82)	(2.93)	(3.23)	(2.55)
Spanish protection	0.00	−0.10	−0.19	0.10	0.09	0.10	0.10
	(0.04)	(−2.06)	(−4.18)	(1.66)	(2.10)	(5.24)	(2.65)
N	577	577	577	577	577	577	577
Adjusted R^2	0.73	0.73	0.74	0.73	0.73	0.74	0.73

Notes: W1 calculated with official values; W2 and W3 calculated with corrected values, the latter including sugar surcharges; W4 calculated with corrected values maintaining the sample fixed; and W5 as W4, for only industrial goods.
S1 calculated for the same sample as W4; S2 for the same sample as W5.
Estimations are country-fixed effects.

4. Results and conclusions

The results of the panel estimations are shown in Table 1 and the first thing to highlight is how the only significant tariff measures that make sense are W4,W5, S1 and S2. That is to say, the only protection measures that, apart from being significant, show the right positive sign are those that keep the sample of goods unchanged over the period under study. Also notice that the difference between the significance of the trade-weighted and the simple average measures, is always stronger for the latter, which, in turn, are the kind of indexes that fit in with the theoretical foundations of the gravity equation.

Finally, it is important to remark how the selection of sound protection measures strengthens the significance of maritime freightson trade, which are even non-significant for W2 and W3.5

Summing up, the use of the gravity equation to derive a comprehensive measure of trade cost on which to regress the alternative indexes of protection, proves to be a useful tool to illustrate the importance of controlling for composition and accounting for the risk of undervaluation when working with aggregated indexes. Furthermore, the soundness of the W4, W5, S1 and S2 averages, since their main difference with the others arises from the increasing trend that the first measures show between the Cánovas Bill of 1891 and the Salvador Bill of 1906, supports the view that assigns a reinforcing protective effect to the latter Bill.6 Finally, the fact that only when considering sound measures of protection and their profile of increasing protection, can maritime freight rates be significantly related to the recovery of the Spanish trade cost tariff equivalent from the nineties on, supports the hypothesized idea of a trade-off between tariffs and transport costs within the first wave of globalization (Williamson, 2003; Jacks et al., 2008).

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Footnotes

1 As Anderson and van Wincoop (2003) put it, for a given bilateral barrier between j and s, higher Spain's multilateral resistance (which means higher barriers between pain and other partners) reduces the relative j-goods prices and raises imports from j. In turn, higher j's multilateral resistance (higher barriers faced by j from the others partners) reduces its supply price and increases its exports to Spain.

2 According to Jacks et al. (2006), to adjust the size of each economy by its total level of exports is a means to proxy the multilateral resistance effect, since the total exports of country j implicitly captures the trade barriers this country faces with all its partners.

3 We have also calculated the measure by assuming elasticity values of 2 and 11. For each of these values, obviously, we obtain a different level of tariff equivalent, but as the profile of the alternative equivalents coincides over time, the selection of one specific elasticity does not alter the conclusions in the next section. We present the results for a value of 5, following preliminary direct estimations by the authors.
4 From 1906 to 1913, the depreciation of the peseta note with respect to the official gold peseta parity was of around 9%.

5 Results are very similar when instead of the data of Jacks and Pendakur (2010), we use different specific-route real freight rates of Mohammed and Williamson (2004) to proxy for Spanish maritime transport costs. Again W4, W5, S1 and S2 are the only significant measures of tariff protection with the right sign.

6 For the chronology and interests revolving around the Spanish tariff reforms over the period 1870–1913 see Serrano Sanz (1987) and Sabate (1996).