The WTO trade effect

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ABSTRACT

This paper re-examines the GATT/WTO membership effect on bilateral trade flows, using nonparametric methods including pair-matching, permutation tests, and a Rosenbaum (2002) sensitivity analysis. Together, these methods provide an estimation framework that is robust to misspecification bias, allows general forms of heterogeneous membership effects, and addresses potential hidden selection bias. This is in contrast to most conventional parametric studies on this issue. Our results suggest large GATT/WTO trade-promoting effects that are robust to various restricted matching criteria, alternative GATT/WTO indicators, non-random incidence of positive trade flows, inclusion of multilateral resistance terms, and different matching methodologies.

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1. Introduction

Since its creation in 1947, the General Agreement on Tariffs and Trade (GATT) has played an important role in the international trading system. It has sponsored eight rounds of trade-policy negotiations that successfully brought down the average tariff rates on industrial goods and also expanded the set of substantive rules governing international trade (beyond tariffs to nontariff barriers, and beyond trade in merchandise to trade in services). This process culminated in the establishment of the World Trade Organization (WTO) in 1995. Since 1947, the GATT/WTO has also grown in its membership from a small set of 23 (mainly developed) countries to a roster that now includes more than 150 countries. Meanwhile, global trade flows have increased exponentially at a rate above the growth rate of merchandise output. It is against this backdrop that the finding by Rose (2004) came as a surprise.

Based on the gravity model of trade (that hypothesizes that the bilateral trade volume between two countries varies positively with their economic sizes and inversely with their bilateral trade resistance), Rose (2004) conducted parametric estimations and found that the GATT/WTO membership status of a country pair had no statistically significant effect on bilateral trade. This negative finding was partially reversed by Tomz et al. (2007) when they reclassified countries according to their participation status in the GATT/WTO (instead of formal membership), and by Subramanian and Wei (2007) when they differentiated the effects by subsets of the sample (e.g., developed versus developing countries). Although shedding light on possible caveats to the original study by Rose (2004), these studies and other follow-up research in this literature have largely followed the conventional approach of parametric estimation. In this paper, we argue that when the leading gravity theories do not have clear guidance on the parametric (functional) relations of the empirical trade-resistance measures, and when the economic theories of trade agreements (e.g., Bagwell and Staiger, 2010, pp. 245–247) suggest that heterogeneous membership effects on trade are important implications (of uneven levels of trade negotiation participation), these existing parametric studies are at risk of misspecification bias on both accounts. We propose a system of nonparametric methods that is

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geared toward these concerns to re-evaluate the GATT/WTO trade effect.

In particular, we apply pair-matching methods to obtain point effect estimates. Following the established gravity theories (Anderson, 1979; Bergstrand, 1985; Deardorff, 1998; Anderson and van Wincoop, 2003), empirical researchers have come to adopt a long list of variables as proxies for the theoretical concept of trade resistance between a pair of countries. This list typically includes (foremost) distance, geographic characteristics, language, colonial ties, currency union, free trade agreement, and the GATT/WTO membership status. However, there is no clear theoretical justification for the linear relation (among the various trade-resistance measures) that is often adopted in the empirical studies. In this paper, we conduct matching based on a set of covariates that is exactly the same as the list of regressors used in parametric studies. However, by matching observations that have different treatment status but are otherwise similar in terms of these covariates, we do not have to take a stand on the functional relations among these observed covariates and hence avoid potential parametric misspecifications. In addition, the matching method by design allows for the treatment (i.e., membership) effect to vary with the observed covariates, and thus it can accommodate arbitrary forms of heterogeneous treatment effects. In general, the homogeneous effect estimate in regression approaches does not correspond to the average of subject-wise heterogeneous effects, if the heterogeneity takes on highly nonlinear functional forms.

We also address other potential econometric concerns arising in the current application. First, given a panel of bilateral trade data, which likely have a complicated data structure with serial and spatial dependence, this paper applies permutation tests that circumvent the difficulty in deriving asymptotic tests. Permutation tests are nonparametric and exact inferences (applicable to finite sample sizes). They are also straightforward to implement in the matching framework. We generalize the test to explicitly allow for heterogeneous treatment effects in constructing the confidence intervals. Finally, we complete the estimation procedure with a nonparametric sensitivity analysis à la Rosenbaum (2002) to formally address potential bias due to unobserved self-selection into membership. We put together the above methods in a coherent manner such that they can be easily applied to other treatment effect problems of a similar nature.

Applying the nonparametric methods to the data set of Rose (2004), we reach a conclusion that is in stark contrast with Rose (2004): membership in the GATT/WTO has large and significant trade-promoting effects. We explore robustness of this result to various possible caveats; the general finding continues to hold. First, both parametric gravity and nonparametric matching estimators rely on the assumption of 'selection on observables'; in other words, non-random selection into membership based on unobservables is assumed away. This assumption may fail if there are important omitted variables. The Rosenbaum (2002) sensitivity analysis partly addresses this problem. Alternatively, we also conduct restricted matching, where we further limit the match to observations from the same 'dyad' (where a dyad indicates a pair of trading countries), the same year, or the same relative development stage. This eliminates potential bias arising from unobserved heterogeneity across dyads, years, or development stages.

Second, Tomz et al. (2007) emphasize the importance of *de facto* participation in the GATT/WTO by colonies, newly independent nations and provisional members, and find strong GATT/WTO effects on trade when this type of nonmember participation is taken into account. We conduct the same nonparametric analysis using the data set of Tomz et al. (2007) and find even stronger results than those based on the Rose (2004) data set.

Third, we verify the robustness of pair-matching by conducting 'kernel-weighting matching', which allows multiple matches for a subject while assigning greater weights to closer matches. The kernel-weighting matching effect estimates are very similar to pair-matching estimates.

Fourth, by using the data set of Rose (2004) or Tomz et al. (2007), we have based our analysis on observations with positive trade flows. Studies by Helpman et al. (2008) and Felbermayr and Kohler (2007) suggest that the incidence of positive trade flows may not be random. To address possible bias due to non-random incidence of active trading relationships, we apply our nonparametric procedures to the subset of the data where a dyad has reported bilateral trade flows before either country in the dyad ever joins the GATT/WTO. For these observations, the membership effect on prompting new trading relationships is not relevant, and hence the effect estimates correspond to only the membership effect on trade volumes. We find overall stronger effect estimates based on this refined analysis.

Fifth, relative, rather than absolute, trade resistance is argued by some gravity theories to be more appropriate in explaining bilateral trade flows (Anderson and van Wincoop, 2003); thus, multilateral resistance terms may have to be controlled for. We follow recent studies by Baier and Bergstrand (2009a,b) to approximate the endogenous multilateral resistance terms by observable exogenous trade resistance covariates in the matching framework. The strong trade effects of GATT/WTO remain.

Finally, we explore an alternative treatment effect concept, difference-in-difference, which is based on weaker identification assumptions and thus could be more robust to potential bias due to selection on unobservables. This method compares the difference over time in the trade volume of a member dyad to that of a comparable nonmember dyad. The matching estimates indicate that the GATT/WTO trade effects are negligible in early phases of the membership, but become statistically and economically significant five or six years after the GATT/WTO accession. To complete the analysis, we conduct placebo exercises and verify that the time trends of trade flows of matched dyads are the same in advance of membership, dismissing concerns that the difference-in-difference estimates may be picking up systematic differences in time trends between member and nonmember dyads due to unobservables not controlled for.

The discrepancy between the finding of the current nonparametric approach and that of the conventional parametric approach suggests that parametric gravity models may be misspecified. We explore generalizing the parametric gravity model's specifications to reduce the discrepancy. Our limited search suggests that the assumption of homogeneous membership effects could be a major source of misspecification. By allowing the membership dummies to interact with observed covariates (and hence allowing the membership effects to vary with dyad-year characteristics), we find the parametric effect estimates to become significant and positive. However, more research into the nature of heterogeneous membership effects seems desirable and we leave this for future research.

The rest of the paper is organized as follows. Section 2 introduces the nonparametric methodologies. Section 3 explains the data used. Sections 4 and 5 present our benchmark estimation results and robustness checks. Section 6 explores potential misspecifications of the parametric gravity models. Section 7 provides our conclusions.

2. Methodology

2.1. Mean effects and matching

Recall that a 'dyad' indicates a pair of trading countries. In the current application, an observation unit corresponds to a dyad i in a year t, while a matched 'pair' indicates two observation units matched on covariates. Let d_{it} denote the observed treatment status of a dyad i in year t, where $d_{it} = 1$ if the subject it is treated and 0 if untreated. The treatment dummy d_{it} takes on different meanings as the treatment under study changes. For example, a dyad-year is 'both-in' treated if both countries of the dyad in the year are GATT/WTO members and untreated if both are nonmembers. Define y_{it}^1 (y_{it}^0) as the potential *treated* (*untreated*) response; in our application, this corresponds to