



**COLLANA DEL
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**TARIFF LIBERALIZATION AND THE GROWTH OF WORLD TRADE:
A COMPARATIVE HISTORICAL ANALYSIS TO EVALUATE THE
MULTILATERAL TRADING SYSTEM**

Silvia Nenci

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Abstract

The aim of this study is to assess the relationship between tariff barriers and world trade growth from a comparative and historical perspective, and –to derive some useful indications for evaluating the effectiveness of the current multilateral trading system for promoting world trade. The novelty of this work is the complex reconstruction of a historical tariffs and trade series for the period 1870-2000, for 23 countries; this constitutes a good proxy for world trade (accounting for over 60%) in this period. The effect of tariff liberalization on trade growth is analysed empirically using panel data and time series. The empirical results, whilst confirming the existence of a world level long-term relationship between tariff reductions and trade growth, demonstrate how this substantial and significant relationship pre World War II gradually diminished in importance and significance after 1950. This result does not conflict with the key role of the GATT/WTO system in the trade liberalization process; however, it underlines the importance of a formalized multilateral trading system, not so much for tariff liberalization, but for building a virtuous process of international coordination of trade policies and ensuring fuller participation in world trade.

JEL Classification: C22, F13, F15, N70

Keywords: Tariffs, World Trade, Multilateral Trading System, GATT/WTO, Historical Series, ECM

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*“the causes which determine the economic progress of nations belong to
the study of international trade”*

(A. Marshall , *Principles of Economics*, 1890)

1. Introduction

Andrew Rose (2004a) has questioned the ability of the GATT (General Agreement on Tariffs and Trade)-WTO (World Trade Organization) system to promote the liberalization of trade policies and stimulate world trade, questioning the reason for the WTO's existence. Rose's contribution has the undoubted merit of placing the role of the WTO at the centre of economic and political debate, producing a destructive effect, and stimulating lively confrontation about the effects of an institutionalized system for world trade (Subramanian and Wei, 2007; Tomz et al., 2007). However, although his criticism is based on wide and detailed empirical analysis, it considers only the years when GATT-WTO was in operation and does not offer comparison with previous periods when an *informal* system was in place.

The present study was motivated by this debate. It aims to answer two specific questions. Has tariff liberalization accelerated the growth of world exports? And, if so, has the GATT/WTO produced significant results in terms of trade liberalization and trade growth with respect to previous periods characterized by a "non structured/institutionalized" (or even absence of a) "regime"?

The analysis in this paper covers more than a century of trade history, including three periods dominated respectively by bilateral trade liberalization, restoration of tariff protections, and multilateral liberalization. It accounts for some of the criticalities of Rose's work referred to above by comparing the expansion of trade in historical periods in which *clubs* with liberalization mandates were created, with those periods when such clubs did not exist (Hufbauer, 2002).

This study provides a long-term empirical analysis of the relationship between tariff liberalization and trade growth. The analysis is conducted at the aggregate level for the period 1871 to 1986, and at panel level for the period 1961-2000. In the latter case, we provide an evaluation of the differences between industrialized countries and developing countries in order to take into account the potential impact of any structural differences among countries in the relationship between tariff liberalization and trade performance.

While the empirical results confirm the existence at world level of a long-term relationship between tariff reductions and trade growth, they demonstrate that this substantial and significant relationship pre-World War II diminished in importance and significance after 1950. This result does not controvert the role of the GATT/WTO system in trade liberalization: rather it underlines the importance of a formalized multilateral trading system, not so much for tariff liberalization, but in order to build a virtuous process of international trade policy coordination and ensure wider participation in world trade.¹

One of the contributions of the present work is the reconstruction of historical data on tariffs and trade for the 23 countries analysed (see Table A.1. in the Appendix), based on print documentation and data banks at individual country level. This study is the first systematic effort to extend this type of analysis across a long historical period using non-standard data (the currently available data are not useful in this context). The second value of this work is in proposing an assessment of the effectiveness of the current multilateral trading system through quantitative comparative analysis with the previous system. Existing work on this issue generally concentrates on short time periods, which do not lend themselves to comparisons among different trade schemes or an overall view of these relationships.

¹ The number of member countries to the multilateral trading system increases from round to round from the 23 countries that signed the GATT in 1947 to the 153 current WTO member countries.

The paper is organized as follows. Section 2 presents the theoretical background to the study; Section 3 offers some stylized facts; Section 4 describes the empirical analysis; and Section 5 concludes.

2. Effectiveness of trade liberalization: theories and empirical evidence

The drive towards trade liberalization and reduction of protectionism is not a new phenomenon. There has been lively debate among economists, on the effectiveness of trade liberalization, for centuries. Dissemination of the free trade doctrine occurred in Europe in the 19th century. Smith's defence of trade in the 18th century and the position adopted by Ricardo in the *Corn Laws* debate, had had concrete effects on the trade policies of European countries. In particular, the 1860 Cobden-Chevalier Treaty, and the introduction of the "most favoured nation" (MFN) clause, played a key role in trade history in the second half of the 19th century (Bairoch, 1976, 1989). Following this treaty, between 1863 and the 1866, most European countries, through treaties signed with France or the UK, became part of a dense network of spontaneous and informal free trade agreements, which became known as "the network of Cobden-Chevalier Treaties". This guaranteed the development of free trade among the main trading powers for around 20 years. The economic depression and profound economic and social consequences of World War I opened the way to a return of protectionism.

From a theoretical standpoint, both the traditional and modern approaches to the theory of trade policy were in substantial agreement that tariffs produce distorting effects on the economy that introduces them, leading to a suboptimal allocation of resources. In contrast, tariff liberalization, in introducing changes to relative prices that determine the shift of resources from the import-substitution goods sectors to the exported goods sectors, lead to a better allocation of resources and, thus, increased production and consumption. Trade policy theory acknowledges also that the existence of valid justifications for the introduction of foreign trade restrictions, as in the classic case of the "infant industry", or the so-called "second best" approach - according to which

it would not be optimal to abstain from trade policy interventions in the presence of domestic market failures, highlights how resorting to protectionism always produces implementation difficulties (i.e. retaliatory measures by trade partners).

From an empirical standpoint, the positions are divergent and the relationship between trade policy and trade growth is not clearly defined. And this is one of the more controversial areas in the economic debate. Analyses based on the second half of the 1900s have produced contrasting results, which at times contradict the theory. Some studies confirm the existence of a direct effect of tariff reduction on trade growth. Among the more significant contributions are the pioneering studies of Balassa (1965, 1967), which analyse the effects of import tariff reductions in industrialized countries, and the impact of industrialized countries' tariffs on imports of manufactured goods from underdeveloped countries, and subsequent developments by Leith and Reuber (1969), which examine also the effects of a reduction in tariff barriers in industrialized countries on developing countries' exports. Through an analysis of individual countries, Krueger (1978) demonstrates that a more liberalized system produces positive effects on exports, although imports respond more quickly to liberalization causing a temporary trade imbalance. In similar vein, Thomas, Nash and Edwards (1991) and Ahmed (2000) demonstrated empirically that trade liberalization processes have a significant impact on the supply function of exports. Bleaney (1999), who measures the effects of trade reforms in Latin America on the growth of trade, using a panel data model, also obtains positive results. Papageorgiou, Michaely and Choski (1992) conduct a cross-country analysis to demonstrate how a change in liberalization regime produces a significant effect on exports, and similar results were obtained by Weiss (1992), Helleiner (1994), Joshi and Little (1996). Leamer (1990), Harrigan (1993) and Trefler (1993) also find significant effects of protective measures on trade flows and Madsen (2001), using a panel model in a study evaluating the effects of a restrictive trade policy on world trade for the period between the two World Wars, finds that the contraction of trade flows in that period was also caused by an increase in tariff barriers. Santos-Paulino and Thirlwall (2004), in a panel analysis of more than 20

developing countries, estimate the effects of trade liberalization on the various components of trade balance and on balance of payments, demonstrate that liberalization in the case of developing countries stimulates exports but even more so imports, producing a worsening of the overall trade and payment balances in these countries.

Contrasting results were obtained by Baldwin and Lewis (1978), Cline et al. (1978), Ray (1981) and Bhagwati (1988), who show that trade liberalization has little impact on imports. In a well-known study on this theme, Ostry and Rose (1992), applying different theoretical models, show that a change in tariff rates produces insignificant effects on the main macroeconomic variables, including trade balance. The UNCTAD (1989) study provides similar results: by presenting a panel data estimate of the impact of liberalization on the trade balances of some industrialized and developing countries, it demonstrates that the origin of a positive effect on the trade balance of developing countries is more favourable terms of trade and more sustained growth in industrialized countries, not trade liberalization itself. The work of Agosin (1991), Clarke and Kirkpatrick (1992), Greenaway and Sapsford (1994), Shafaeddin (1994) and Jenkins (1996) also find little evidence to support a relationship between trade liberalization and export growth. And, Nenci and Pietrobelli's (2008) empirical analysis estimating the effect of trade liberalization on import performance in selected Latin American countries for the whole of the 20th century, shows that there is a long run relationship between tariff reduction and import growth only for the second half of the 20th century when there was integration within a wider process, which implies a multilateral and negotiated approach to trade policy.

The debate becomes even more contentious when this type of analysis is associated with efforts to assess the effectiveness of the current multilateral trading system for promoting tariff liberalization and trade expansion. This "formal" system, originating in the GATT (1947) and developing in the WTO (1995), has been compared to the "informal" pre-GATT system, which was characterized by a network of bilateral trade agreements and began with the 1860 Cobden-Chevalier Treaty, including the MFN rule. Distinguished scholars assert that the beginning of a

liberal trading order started before the GATT/WTO, with the creation of the network of MFN bilateral treaties (Bairoch 1989; Irwin 1993; O'Rourke and Williamson 1999). Other scholars consider the role played by the GATT/WTO system in the second half of the 20th century as not a determinant of world trade promotion through trade liberalization, arguing that the *formalization* of the system, through the signing of multilateral agreements, did not produce the expected results and did not lead to substantially different results than those produced by the previous trading system. In this respect, we need to refer to the empirical contributions of Rose (2004a, 2004b, 2005), which inspired this study. Using a gravitational model estimated for more than 170 countries, Rose (2004a) evaluates the outcome of the GATT/WTO in terms of liberalization and promotion of world trade. The results of his analyses have had a destructive effect on the economic and political debate linked to the role and contribution of the WTO, and stimulated heated argument amongst the experts. Some criticize Rose, challenging the quality of the trade flow measurements in his work (Low, 2002), and claiming that the WTO's mandate is broader than simple trade liberalization. Others (Hufbauer, 2002) suggest that the correct test for the success of the GATT/WTO would be to compare the expansion of trade in historical periods when the clubs with liberalization mandates were born, with those periods when such clubs did not exist, rather than an analysis limited to examining the period of the current system. In response to Rose's conclusions, Subramanian and Wei (2007), using the same data, and perfecting Rose's econometric model,² provide robust evidence that the GATT/WTO has had a significant and positive impact on the trade of member states, although the impact differs due to the asymmetries within the GATT/WTO system. Subramanian and Wei demonstrate that the growth in trade flows of the industrialized countries acceding to GATT/WTO is higher than similar growth in the developing countries that are also part of the system. Lastly, Tomz *et al.* (2007) show that Rose's analysis overlooks a large group of countries to which the trade

² The authors maintain that the model used by Rose is methodologically incomplete in not taking account of the results obtained by Anderson and van Wincoop (2003) on the introduction of fixed effects by country within the gravitational equation, or of the asymmetries within the GATT/WTO system.

agreement applies and classifies them incorrectly as non-participants. This causes a downward bias in his estimates of the GATT effect. They argue that the GATT and its successor the WTO have had substantial positive effects on trade.

The debate prompted by these contributions is the starting point of the empirical analysis in this paper.

3. Stylized facts

There is widespread agreement that the post World War II period has been characterized by a gradual strengthening of international economic interactions, evidenced by the presence of intense and increasing world trade in goods, services and flows of capital. This phenomenon of growing *interaction* has been accompanied by economic *integration* at the international level, intended as a process of tariff reduction.³

Analysis of the data on trade and financial flows in the second half of the 20th century would seem to confirm the hypothesis of a high level of *interaction* at world level. World data show sustained trade growth in this period, exceeding growth in gross domestic product (GDP). In addition, since the 1960s, the industrialized countries have achieved an increase of 50% on average, in degree of trade openness (Baldwin and Martin, 1999). Financial openness shows an average increase of around 70% in the industrialized countries over the same period, while world foreign direct investments (FDI) have increased by more than 14 times since the 1980s (UNCTAD, 2004).

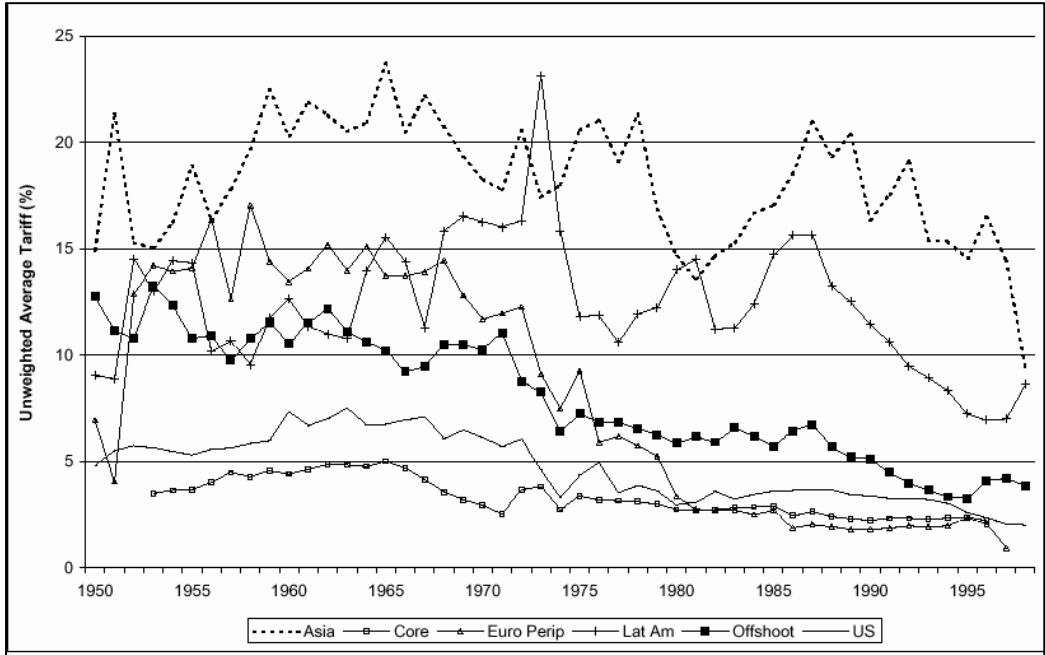
This increased *interaction* seems also to have been accompanied by economic *integration* at the international level, shown by the declining trends for tariff barriers (see Fig. 3.1 for regional trends).

The effective existence of a post-war *interaction-integration* phenomenon and especially its extraordinary nature, are not universally accepted among scholars. Some believe that this is not a

³ We use the term “interaction” to refer to the general phenomenon of increased world trade linkages and “integration” to refer to the process of trade liberalization.

new phenomenon and provide evidence of an occurrence between the end of the 1800s and World War I, thus divesting the current situation of its singularity (see Sachs and Warner, 1995). Similarly, Baldwin and Martin (1999) stress that economic history reveals the existence of two waves of globalization: the first in the period between 1820 and World War I; the second in the period from 1960 to the present. In both cases, there was significant trade and financial openness, and transformations in national production structure and relative prices. In terms of the process of economic *integration*, both globalization waves highlighted coincide with substantial reductions in natural and artificial trade barriers, i.e. decreased transport and transmission of information costs (see Bairoch, 1989; Baldwin and Martin, 1999; Estevadeordal et al., 2002), and reduced barriers to the trading of goods and factors.

Figure 3.1. – Average of regional tariffs after World War II

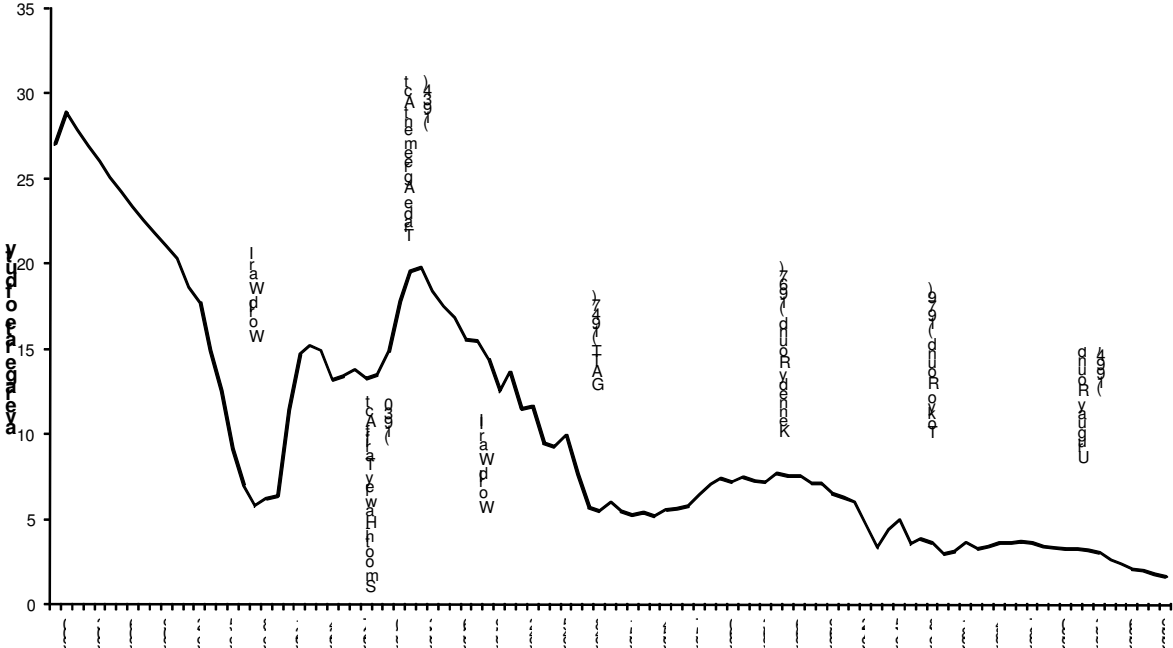


Legend:
Asia: Burma, Ceylon, China, Egypt, India, Indonesia, Japan, the Philippines, Siam, Turkey
Core: France, Germany, UK
Euro periphery: Austria-Hungary, Denmark, Greece, Italy, Norway, Portugal, Russia, Serbia, Spain, Sweden
Latin America: Argentina, Brazil, Chile, Cuba, Colombia, Mexico, Peru, Uruguay
Offshoots: Australia, Canada, New Zealand

Source: Coatsworth and Williamson, 2002

We can take the example of the US, where data show that the trend in average tariffs on imports began to decrease after the 1934 *Trade Agreements Act* and this decrease became even more marked following the birth of the GATT and the subsequent multilateral negotiation rounds. If we extend the period of observation, we can see that, excluding the period between the two World Wars, the fall in US tariffs began at the start of the 20th century (see Fig. 3.2).

Figure 3.2. Average tariffs on US imports (1900-2000)



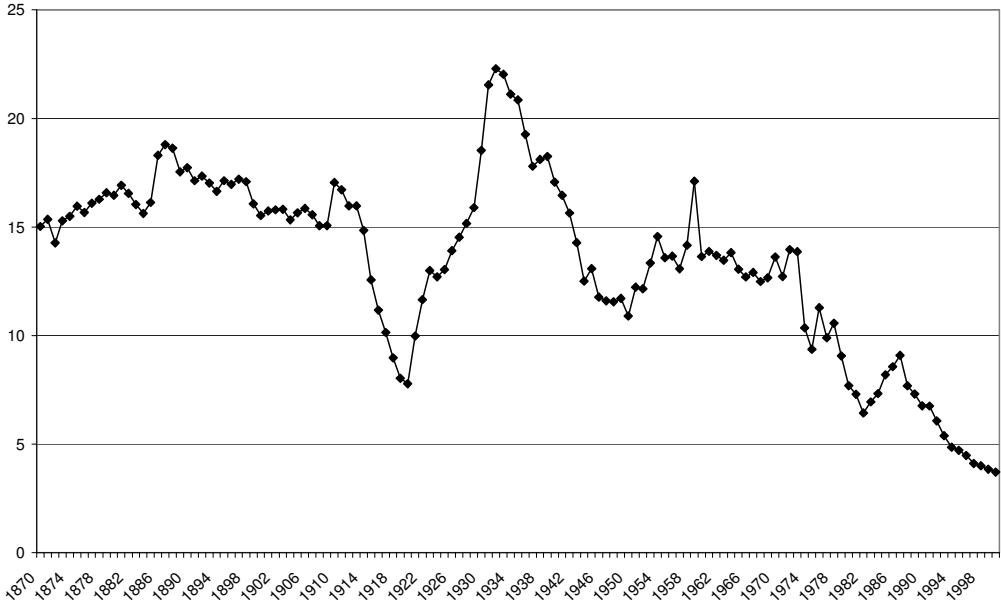
Source: Adapted from Coatsworth and Williamson (2002) and World Bank (2003)

If we go back to the second half of the 19th century, we can see that what appeared to be a phenomenon related to a specific trading system was in fact part of a trend already established before the system was introduced. In the case of the US, the phenomenon seems to have originated long before the birth of the GATT.

But what about the situation at world level? If we analyse tariff data for the main world trading powers and aggregate them to obtain a world proxy, we can identify an overall downward trend in average tariffs with the exception of the years between the two World Wars (Fig. 3.3), whilst

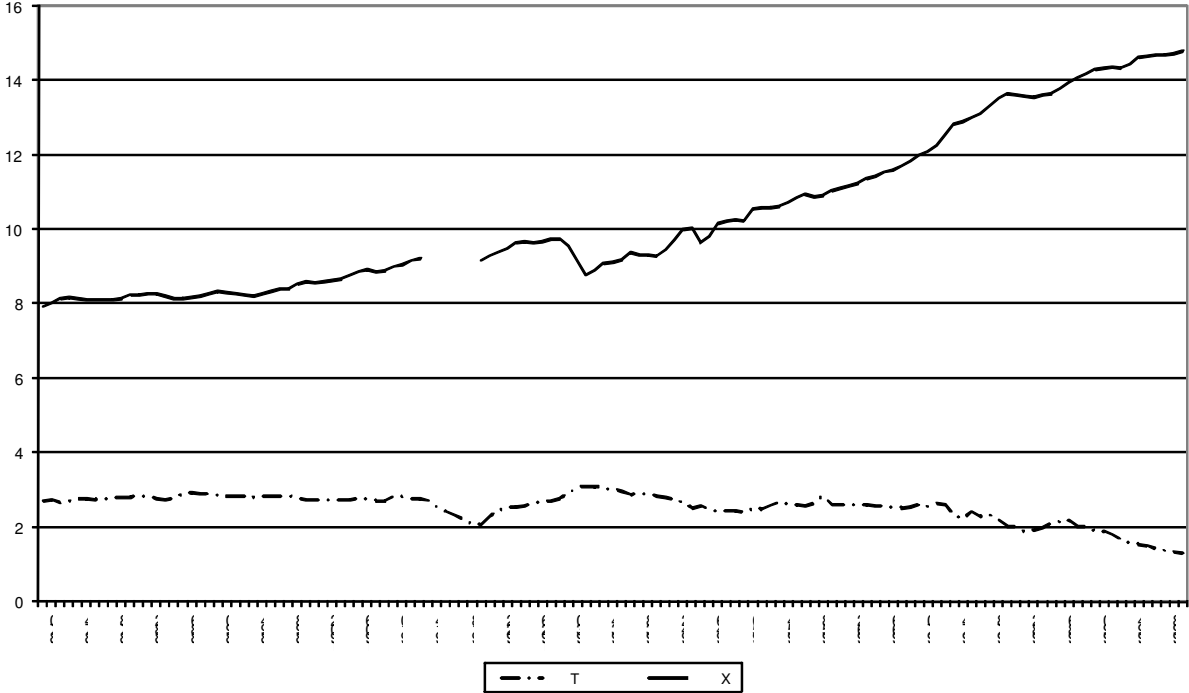
separate analyses of the historical series of tariffs and average world exports highlight a negative relationship between these two variables⁴ (Fig. 3.4).

Figure 3.3. – Average of world tariffs (1870-2000)



Source: Adapted from Coatsworth and Williamson (2002) and Mitchell (1992)

Figure 3.4. – World average tariffs and world exports (1870-2000, logs)



Source: Adapted from Coatsworth and Williamson (2002), Mitchell (1992) and Maddison (1989)

⁴ This relationship is also confirmed if we analyse the rate of change for these variables.

Despite this empirical evidence, we think it risky to derive a direct relationship between the process of *interaction* (i.e. increase in trade flows) and the process of *integration* (i.e. the reduction in trade barriers) based on the above analysis.

4. Tariff liberalization and trade growth: an empirical test

This empirical exercise aims to contribute to the debate on the effectiveness of trade liberalization policy and the impact of the multilateral trade integration process on trade growth. The empirical test is carried out using different estimation techniques including time series and panel data analyses.

4.1. Aggregate analysis

The first part of the empirical exercise is to verify the existence of a long-run relationship between tariff barriers and trade flows at world level. The aggregate analysis covers the period 1870-1986 and includes the main trading countries in that period (23 countries, see Table A.1 in the Appendix). Since these countries account for over 60% of world trade in the period (see Fig. A. 1. in the Appendix), their aggregate trade can be used as a proxy for world trade.

To estimate the impact of a reduction in tariff barriers on world trade flows represented by exports, the empirical model is based on the standard export demand function (Goldstein and Khan, 1985; Senhadji and Montenegro, 1999; Thirlwall, 2003) commonly used in the empirical trade literature.⁵ The basic estimating equation takes the following specification:

$$\ln X_{wt} = \alpha_1 \ln Y_{wt} + \alpha_2 \ln P_{wt} + \alpha_3 \ln T_{wt} + \alpha_4 \ln X_{wt-1} + v_t \quad [1]$$

where X_w indicates the level of world exports (as a proxy for world trade); Y_w is the level of world income; P_w is a measure of relative competitiveness (the ratio between the price of manufactured

⁵ Most studies of export performance derive the demand function for exports according to traditional trade theory. In our case we are forced to adopt this approach due to the impossibility of modelling the new trade theory approach using historical data.

goods exports, and the price of primary commodities exports at time t);⁶ T is the average world tariff (the ratio of import customs revenue and the value of imports); X_{t-1} is the level of world exports at time $t-1$; v is the error term; and the t index indicates time. The short-run elasticities of exports with respect to income, prices and tariffs are, respectively: α_1 , α_2 e α_3 and the expected signs are: $\alpha_1 > 0$, $\alpha_2 < 0$ e $\alpha_3 < 0$.

The data used in the test are derived from a complex reconstruction of the historical series for the 23 economies, often on the basis of print documentation and databases on individual country (see the Appendix for a detailed explanation of the data sources). This is undoubtedly the main value of this work although some caveats need to be applied. We rely on a limited range of available statistical data and, in some cases, their reliability must be treated with caution.⁷ Also, in the more recent years a gradual reduction in tariff barriers has been paralleled by an increased use of so-called "non-tariff" barriers. This should be taken account of when comparing the relationship between tariff and trade liberalization across different historical periods. Finally, since tariffs in developing countries are higher than those in industrialized countries, and are very high in absolute terms, there may be an inverse relationship between the levels of nominal tariffs and effective imports (namely between tariff and customs duties), which might influence the value of the indicator used to measure tariff barriers. In the case of developing countries, this indicator could be distorted downwards and could lead to incorrect interpretations (e.g. a prohibitive tariff, wearing away imports and tariff revenue, could be interpreted as a zero tariff

⁶ Under the (strong) assumption that industrialized countries mainly export manufactured goods while developing countries mainly export primary commodities, this index can be considered to be a measure of the relative competitiveness of industrialized and developing countries. Thus, an improvement in the competitiveness of developed countries (i.e. a reduction in the index value) leads - ceteris paribus - to an increase in world trade flows. Although this measure of competitiveness may be considered rather rough, it is the only historical measure available (and reliable) to proxy for terms of trade.

⁷ All comparative tests, especially for long time periods, have methodological issues related to reliability, consistency and comparability of the data series. This is particularly true for the data pre the second half of the 20th century. For the historical country comparison for this period it is reasonable, nevertheless, to assume that the margins of difference in the figures from original sources are more or less comparable for every country, so these statistics can be considered to be acceptable, although imperfect, indicators.

rate). This problem is certainly present but is not considered sufficiently significant to affect the analysis at the aggregate level.

The basic estimating equation [1] is differentiated with respect to time⁸ giving:

$$x_{wt} = a_1 y_{wt} + a_2 p_{wt} + a_3 t_{wt} + \alpha_4 x_{wt-1} + \mu_t \quad [2]$$

where x_w is the rate of change in world exports, y_w is growth in world income, p_w is the rate of change in relative prices, t_w is the rate of change in average world tariffs, x_{wt-1} is the rate of change in world exports at time $t-1$, and μ is a stochastic error term.

As the relation is very long run, we test also for the existence of a structural change in the model.

As expected, the stability tests indicate high probability of a structural change in the model in the early 1950s;⁹ consequently, we subdivided the model for two sub-periods - 1870-1939¹⁰ and 1951-1986.

Given the presence of the series I(1), we investigated the existence of a possible cointegrated relationship between the dependant variable and the regressors for the two sub-periods considered.¹¹ It is well known that when a cointegrating relationship is proved, a first difference model is not an appropriate tool because of the lost of valuable information on the long run relationship between the dependent and the independent variables (Hamilton, 1994).¹² A cointegrating relationship between the dependent variable and regressors emerged for the 1951-

⁸ Before estimating the model, the stationarity of export, income, price and tariff time series was tested using the ADF – Augmented Dickey-Fuller (Dickey and Fuller, 1979) and PP-Phillips and Perron (Phillips and Perron, 1988) unit root tests. As both the tests show a very high probability of the existence of a unit root in all the series, and therefore nonstationarity in the levels, first differences of the variables were considered (Hamilton, 1994). The same tests confirmed the first differences were stationary, leading to the conclusion that the variables are integrated by the order of 1.

⁹ The F-statistic of the Chow Breakpoint Test for 1950 is 3.53 with a probability of 0.006 and the Log likelihood ratio is 18.01 with a probability of 0.002.

¹⁰ To avoid possible distortions, the analysis does not include the World War II years or those immediately following.

¹¹ To enquire into the existence of a possible cointegrating relationship between the dependent variable and the regressors, we used the ARDL - Autoregressive Distributed Lag – approach (Pesaran and Pesaran, 1997; Pesaran and Shin, 1999). The ARDL procedure involves two stages. In the first stage the existence of the long-run relationship between the variables under investigation is tested by computing the F-statistic to test the significance of the lagged levels of the variables in the error correction (EC) form of the underlying ARDL model. The calculated F-statistic is compared with the critical value tabulated in Pesaran and Pesaran (1997). In the second stage we estimate the coefficients of the long-run relation and make inferences about their value.

¹² The theory of cointegration addresses this issue by introducing an EC term (Engle and Granger, 1987). The EC term lagged one period (ECt-1) integrates short-run dynamics in the long-run function.

1986 period.¹³ Hence, we employed an Error Correction Model (ECM)¹⁴ to this period and estimated an in differences model for the 1870-1939 period using the ordinary least squares (OLS) method.

The empirical specification in equation [2] was modified in order better to specify the effect of trade liberalization measures on the observed relationship, through the introduction of dummy variables (Rose, 2004a, 2004b; 2005; Santos-Paulino and Thirlwall, 2004; Pacheco-Lopez, 2005). The dummy dCC was used to assess the effects on world trade of the network of bilateral treaties subsequent to the 1860 Cobden-Chevalier Treaty. This variable highlights the existence of a “further” liberalization effect compared to the effect linked specifically to the reduction in tariff barriers captured by the relative coefficient.¹⁵ The dummy $d1929$ takes account of the possible effects of the 1929 world economic crisis on the model.

The estimated model thus becomes:

$$x_{wt} = a_1 y_{wt} + a_2 p_{wt} + a_3 t_{wt} + a_4 x_{wt-1} + a_5 dCC_{wt} + a_6 d1929 + \mu_t \quad [3]$$

where dCC and $d1929$ are binary dummies.¹⁶

In the estimate for the period 1951-1986¹⁷ using the ECM¹⁸ the specification is as follows:

$$x_{wt} = \sum_{i=1}^n a_{1i} y_{wt-i} + \sum_{i=1}^n a_{2i} p_{wt-i} + \sum_{i=1}^n a_{3i} t_{wt-i} + \sum_{i=1}^n a_{4i} x_{wt-i} + a_5 EC_{t-1} + a_6 dround_t + \mu_t \quad [4]$$

where $EC_{t-1} = \delta_1 \ln X_{wt-1} + \delta_2 \ln Y_{wt-1} + \delta_3 \ln P_{wt-1} + \delta_4 \ln T_{wt-1}$

¹³ The F-statistic for this sub-period takes the value of 6.43. Comparing this with the interval of critical values (from 5.02 to 6.01) under the assumption of no intercept and no trend, the null hypothesis of no long-run relationship between the variables at the 1% significance level is rejected.

¹⁴ The ECM is commonly used when both the short-run dynamics among the variables and the long-run economic relationship need to be considered. A formal explanation of the dependent variable variations is attempted in terms of the function of the explanatory variable variations, and the delayed deviation in the theoretical relationship. Also, the ECM specification allows all the available information to be extracted from the data without infringing, *a priori*, the classical hypotheses and, if the equilibrium relation has been correctly specified, the long-run deviation series will be stationary (Engle and Granger, 1987).

¹⁵ A typical effect of this type is, e.g., the formation of a more favourable international trade climate.

¹⁶ They take the value of 1 if the event occurs and 0 otherwise.

¹⁷ The estimates relating to this period are the aggregate values for all 23 countries.

¹⁸ The ECM and the long run parameters are estimated using the ARDL method. We used a one lag length of the explanatory variables, while the order of the ARDL model was determined using the Schwarz Bayesian Criterion (SBC). The estimates were made using the Microfit econometric program.

EC_{t-1} is the lagged EC term and the residual from the cointegrating regression equation [3]. The ECM shows how the system converges to the long-run equilibrium implied by the cointegrating regression. The coefficient a_5 in equation [4] represents the response of the dependent variable in each period to a departure from equilibrium, and its absolute value shows how quickly equilibrium is restored. This approach makes it easier to distinguish between short-run and long-run real exports functions.

We used specific dummies to measure any subsequent effects of liberalization with respect to tariff liberalization resulting from the succeeding GATT negotiating rounds.¹⁹ These include: *dROUND1* to disclose the liberalization effects linked to the Torquay (1951) and Geneva (1956) negotiations; *dROUND2* for the liberalization effects linked to the Dillon (1960-62) and the Kennedy (1962-67) Rounds; and *dROUND3* for the liberalization effects of the Tokyo Round (1973-79).²⁰

4.1.1. Outcome of the aggregate analysis

The analysis relating to the period prior to World War II, 1871-1939, tested by OLS regressions on first-order differenced data, is based on aggregate data from nine industrialized countries (Canada, Denmark, France, Germany, Italy, Norway, Sweden, US and UK).²¹ The relationship presents robust and significant parameter values and the signs of the coefficients are as expected (Table 4.2). In particular, the theoretical hypothesis of a direct relationship between export growth rate (as a proxy for growth in world trade) and world income annual growth rate, and the inverse relationship between export growth rate and the rate of change in tariffs at world level are confirmed. The hypotheses of a significant effect of trade liberalization linked to the presence of the post-*Cobden-Chevalier Treaty* agreements network, and of a specific effect linked to the 1929

¹⁹ We decided to indicate the most significant (in terms of tariff cuts and country participation) rounds with a single dummy, while the least important rounds we grouped together. Dummies combining more rounds assume the value 1 starting from the year following the end of the previous round (*dROUND2*, for instance, takes the value 1 from 1968).

²⁰ The 1986-1994 Uruguay Round was not taken into consideration due to lack of observations.

²¹ The statistical data relating to the other countries of the sample are only available from 1930 onwards.

crisis are not confirmed. Although it is clear from the statistical data that in the years immediately following the crisis, there were surges in protection levels and consequent drastic reductions in international trade flows, this dynamic is perfectly consistent with the basic characteristics of the estimated model, and does not imply any structural changes. In particular, all the estimates indicate an important relation between the change in tariffs and the change in trade: in all cases, the change in tariffs is almost proportional to the change in trade. This elevated elasticity of exports to changing tariffs, which, as we show later, is not confirmed by analysis of the post-World War II period, might in part be justified by a higher average tariff level (roughly around 30%) in the period considered. This high level of tariff barriers would render trade policy particularly effective for determining international trade flows.

Since data on price variables are available only from 1900, we estimated another version of the model (Table 4.2, model 4) for the period 1901 to 1939 based on the aggregate values for a group of 14 countries - the previous 9 plus 5 Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Peru). The estimates for 1901-39 confirms the previous results, while the introduction of the variable for relative prices, which allows the model to be specified more appropriately, shows that they are robust and significant. In particular, the price variable coefficient has a negative sign, highlighting an inverse relationship between price variations for manufactured goods compared to primary commodities, and changes in trade flows.

Table 4.2

OLS 1871-1939

<i>Explanatory variables</i>	Dependent variable: EXPORT GROWTH ¹ [x_w]			
	1	2	3	4 ³
Lagged export growth [x_{wt-1}]	0,2526 (2.41)**	0,2547 (2.41)**	0,2491 (2.37)**	0,2824 (4.56)***
World income growth ² [y_w]	0,2617 (2.24)**	0,2707 (2.24)**	0,2511 (2.13)**	1,0891 (3.80)***
Tariff change [t_w]	-0,9728 (6.68)***	-0,9469 (5.69)***	-0,9851 (6.70)***	-0,8114 (3.07)***
International price change [p_w]				-0,4274 (2.71)***
1929 Crisis dummy [d1929]		0,0101 (0.33)		
Cobden-Chevalier Treaties net dummy [dCC]			0,0181 (0.78)	
F-test	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Breusch-Godfrey test (Prob.>chi2)	[0.3111]	[0.2854]	[0.3385]	[0.5315]
Akaike info criterion	-2,5702	-2,5376	-2,5470	-1,8998
Schwarz criterion	-2,4281	-2,3599	-2,3694	-1,6619
No. of observations	58	58	58	30

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

¹ Exports of the 9 main world export countries.

² Sum of income values of 29 countries (about 70% of world income for the period considered).

³ The empirical test relates to the 1901-1939 period and the value of the variables relates to 14 countries.

The outcomes of the estimates for the 1951-1986 period are reported in Tables 4.3 and 4.4.²²

With regard to the ECM, the theoretical hypothesis of a direct relationship between export growth rate (as a proxy for growth in world trade) and world income annual growth rate is confirmed; the relation between the rate of change for exports and the rate of change for tariffs is hardly significant. The ARDL approach²³ confirms the existence of a positive long run relationship between world exports and world income, all expressed in levels, and the presence of a negative long run relationship between world exports and average tariffs, again in levels. The results confirm also an inverse relationship between change in trade flows and price changes in

²² The long-run coefficients derived from the ARDL procedure (1,1,0,1) were estimated using the Microfit econometric program.

²³ See fn 11 for an explanation of the ARDL approach.

manufactured goods compared to primary goods. The greater significance of the EC term confirms the validity of the long-run equilibrium relation. The not particularly high value of the EC term, however, indicates that adjustment of the model to the long-run equilibrium values is slow.

Table 4.3

ECM derived from the ARDL approach 1951-1986

Explanatory variables	Dependent variable: EXPORT GROWTH ¹ [x _w]				
	1	2	3	4	5
World income growth ² [y _w]	3,0378 (3.43)***	3,3009 (3.91)***	3,3063 (3.85)***	3,1019 (3.80)***	3,2905 (3.82)***
Relative price change [p _w]	-0,3998 (4.12)***	-0,3344 (3.68)***	-0,3396 (3.50)***	-0,3067 (3.47)***	-0,3296 (3.39)***
Tariff change [t _w]		-0,0168 (0.01)	-0,7369 (0.00)	-0,0497 (0.37)	-0,0076 (0.05)
EC (-1)	0,0513 (2.95)***	0,1450 (3.61)***	0,1413 (2.98)***	0,2970 (1.74)*	0,1421 (3.15)***
Annency-Torquay-Geneva Round dummy [dR ₁]			0,0570 (0.15)		
Dillon-Kennedy Round dummy [dR ₂]				0,0722 (1.90)*	
Tokyo Round dummy [dR ₃]					0,0088 (0.15)
F-test	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Akaike info criterion	44,4090	47,9520	46,9665	49,0642	46,9669
Schwarz criterion	41,2420	43,2014	41,4242	43,5219	41,4245
No. of observations	37	37	37	37	37

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

¹ Exports of the 23 main world export countries.

² Sum of income values of 29 countries (about 70% of world income for the period considered).

Finally, the estimates are consistent with the findings for the dummy variable for the *Cobden-Chevalier Treaty* in the 1871-1939 period and underline the scarce significance (also for the GATT) of the dummy for the various negotiating rounds. Also, in this case, the multilateral trade agreements do not seem to determine any further effects on the process of trade liberalization with respect to those relating to the reduction in tariff barriers. With regard specifically to the post-World War II period, the effect of tariff barrier changes on world trade flow changes is

much less significant than in the previous period, although confirmed from the point of view of long-run equilibrium.

To conclude, if on the one hand the estimates confirm the existence of a long-run relationship between tariffs and trade, on the other hand they demonstrate how this relation diminishes in importance and meaning over time, probably in the function of the loss of importance of tariff barriers in the context of trade policy at international level and the parallel emergence of so-called non-tariff barriers.

Table 4.4

Long-run coefficients derived from the ARDL approach 1951-1986	
Dependent variable: EXPORTS ¹ (ln) [x _w]	
Explanatory variables	1
World income (ln) ² [Y _w]	1,0870 (24.37)***
Relative prices (ln) [P _w]	-2,3053 (2.76)***
Tariffs (ln) [T _w]	-1,9967 (5.98)***
No. of observations	36

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

¹ Exports of the 23 main world export countries.

² Sum of income values of 29 countries (about 70% of world income for the period considered).

4.2. Panel data analysis

We conducted another exercise using panel data, which have the advantage that they enrich the empirical analysis.²⁴ In order to retain symmetry with the previous analyses, the panel was built using data related to the 23 countries considered in the aggregate exercise. It is important to

²⁴ Panel data consider the longitudinal dimension of data control for heterogeneity among units and allow less collinearity among the variables, producing more reliable parameter estimates (Baltagi, 2001).

underline that the estimated relationship in the regression panel is different from the previous estimates in that objective of the aggregate analysis was to measure the impact of average world tariffs on world trade at the aggregate level and, therefore, the choice of export or import flows as the dependant variable was immaterial. The panel model aims to provide additional information on the impact of tariff liberalization on the import flows of the countries considered. The empirical specification stems from the standard import demand function applied in the empirical trade literature (Leamer and Stern, 1970; Goldstein and Khan, 1985; Thirlwall, 2003). The basic estimating equation takes the following form:

$$\ln M_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_t + \beta_3 \ln T_t + \beta_4 \ln M_{t-1} + \omega_t \quad [5]$$

where M_t is the level of imports; Y is the level of domestic income; P is relative export and import good prices measured in a common currency (i.e. international terms of trade); T is the tariff (customs duty, measured as the ratio of customs revenue and import value); M_{t-1} is the lagged dependent variable; and ω is a stochastic error term.

The short run income, price and tariff elasticities are β_1 , β_2 and β_3 respectively and the expected signs are: β_1 and $\beta_2 > 0$; $\beta_3 < 0$.

Differentiating with respect to time gives (Madsen, 2001; Santos-Paulino and Thirlwall, 2004):

$$m_{it} = b_i + b_1 y_{it} + b_2 p_{it} + b_3 t_{it} + b_4 m_{it-1} + \varepsilon_{it} \quad [6]$$

where m is the rate of change of imports, b_i is a constant (the country fixed effect), y is the growth in domestic income; p is the rate of change of the international terms of trade; t is the rate of change in tariffs; $m_{i,t}$ is the lagged dependent variable growth; ε is a stochastic error term; i is the country and t is time.

This model [6], like the previous model in the aggregate analysis, is modified to better specify the impact of the multilateral trade integration process on the relationship analysed.

We use dummies for the GATT negotiation rounds. The estimated model thus becomes:

$$m_{it} = b_i + b_1 y_{it} + b_2 p_{it} + b_3 t_{it} + b_4 m_{i,t-1} + b_5 dROUND_5 + \varepsilon_{it} \quad [7]$$

where $dROUND_5$ is a binary dummy for the negotiation rounds introduced in the aggregate analysis (which takes the value 1 if it applies to the country and 0 otherwise).

The data in the panel model are from the World Bank World Development Indicators (WDI, 2003) and cover the period 1960 to 2000. Therefore, in contrast to the aggregate analysis, we are using standard data, frequently used to study these phenomena.²⁵ The model is a fixed effects panel model,²⁶ which allows the individual effects of each unit representing specific and constant factors to be modelled (Greene, 1997). The fixed effects model was chosen because, in this case, country-specific effects are important for analysing the impact of a specific element (i.e. tariffs) on trade. The country specific effects are deterministically related to the country specific characteristics and, thus, cannot be considered random. Moreover, a fixed effects estimator, where the constant term includes all the country-specific characteristics, avoids misspecification problems due to omitted variables.

An estimate of the entire group of countries is carried out, followed by an analysis disaggregated by groups, distinguishing between industrialized and developing countries. The model is also estimated taking account of trade levels rather than changes.

4.2.1. Outcome of the panel analysis

The estimates highlight the goodness of fit of the estimated relation (Table 4.5). The values of the parameters are robust and significant and the signs of the coefficients are as expected. In particular, the positive relationship between rate of growth in imports and change in domestic income is confirmed, as is the positive variation between rate of growth of imports and

²⁵ We take account of annual imports of goods and services (constant US\$ 1995 values), annual income (constant US\$ 1995 values), terms of trade index for goods and services (1995=100) and customs duties expressed as percentages of imports.

²⁶ Using the standard within-group estimator for dynamic models with fixed individual effects usually generates inconsistent estimates since the number of "individuals" tends to infinity if the number of time periods is kept fixed (see Nerlove, 1967; Nickell, 1981). This is particularly the case if the time dimension for the panel (T) is small and N tends to infinity, and the bias is of order 1/T. However, as the number of temporal periods in this analysis is quite high (for panel data), the distortion produced by the inclusion of the lagged dependent variable will be slight.

international terms of trade. In terms specifically of the relationship between changes in tariffs and changes in imports, the panel analysis highlights the small significance of the role of tariff barriers, which is consistent both with the results of the aggregate analysis for the relationship between trade and tariffs in the period 1951-1986 and with the fact that tariff barriers gradually diminish in importance in that period compared to other forms of trade restrictions. In terms of the effect of further liberalization related to the various negotiating rounds, the Tokyo Round seems to play a significant, although not particularly relevant role. This is perhaps because the Tokyo Round differed from previous rounds since it promoted both a cut in tariff barriers and a reduction in non-tariff measures and established codes of conduct; these measures may have had a positive impact on international trade flows in particular.

Table 4.5

Fixed effects panel analysis 1961-2000			
<i>Explanatory variables</i>	Dependent variable: IMPORT GROWTH [m]		
	1	2	3
Lagged import growth [m _{t-1}]	0,0852 (2.65)***	0,0849 (2.65)***	0,0616 (1.92)***
Domestic income growth [y]	2,4050 (20.14)***	2,4048 (20.14)***	2,4213 (20.62)***
Tariff change[t]	-0,0123 (1.22)	-0,0115 (1.15)	-0,0006 (0.59)
Relative price change [p]	0,2389 (4.62)***	0,2417 (4.67)***	0,2278 (4.47)***
Constant [c]	-0,0209 (4.12)***	-0,0509 (1.78)**	-0,0325 (5.67)***
Dillon-Kennedy Round dummy [dR ₂]		0,0358 (1.06)	
Tokyo Round dummy [dR ₃]			0,0321 (4.10)***
F-test	[0.0000]	[0.0000]	[0.0000]
R ²	0,53	0,53	0,55
No. countries/No. observations	23/481	23/481	23/481

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

To achieve a better understanding of the structural differences between the groups of countries considered, we separately estimated the observed relation between the industrialized and developing countries.²⁷ The main difference between the two groups is the greater significance of the relationship between trade liberalization and tariff barriers in the case of the industrialized countries. The estimate for this group of countries (Table 4.6) highlights that the coefficients referring to tariff changes and the dummies relating to the multilateral rounds within the GATT are more significant (although not particularly relevant) than those for the group of developing countries (Table 4.7). Nevertheless, in both the developing and the industrialized countries, the further effect of liberalization linked to the Tokyo Round results is significant, although only moderately so.

The higher significance of the relationship between trade liberalization and tariff barriers in the case of the industrialized countries confirms the existence of a structural difference between the two groups of countries in relation to the elasticity of trade flows to tariff changes²⁸. However, this empirical finding may be due to the fact that the developing countries liberalized very little in the post-war period, often adopting "free-rider" behaviour, or taking advantage of the liberalization measures adopted in the industrialized countries, without any obligations for reciprocity.²⁹

²⁷ The industrialized countries include: Australia, Canada, Denmark, France, Germany, Italy, Japan, New Zealand, Norway, Portugal, Spain, Sweden, UK and the USA. The developing countries include: Argentina, Brazil, Chile, Colombia, Philippines, India, Mexico, Peru and Turkey

²⁸ Similar finding in Rose 2004b, although achieved through a different econometric model

²⁹ In terms of the results for the developing countries, it should be remembered that the results might be distorted due the previously mentioned problems linked to the measurement of tariffs (see section 4.1).

Table 4.6

Fixed effects panel analysis -Industrialized Countries 1961-2000

<i>Explanatory variables</i>	Dependent variable: IMPORT GROWTH [m _{it}]		
	1	2	3
Lagged import growth [m _{t-1}]	-0,0012 (0.03)	-0,0027 (0.06)	-0,0248 (0.60)
Domestic income growth [y]	2,1877 (15.35)***	2,1921 (15.43)***	2,2347 (15.85)***
Tariff change [t]	-0,0126 (1.85)**	-0,0118 (1.73)*	-0,0082 (1.20)
Relative price change [p]	0,2336 (4.38)***	0,2414 (4.53)***	0,2170 (4.12)***
Constant [c]	-0,0112 (2.28)**	-0,0475 (2.27)**	-0,0177 (3.38)***
Dillon-Kennedy Round dummy [dR ₂]		0,0370 (1.79)*	
Tokyo Round dummy [dR ₃]			0,0199 (3.24)***
F-test	[0.0000]	[0.0000]	[0.0000]
R ²	0,49	0,49	0,50
No. countries/No. observations	14/303	14/303	14/303

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4.7

Fixed effects panel analysis - Developing Countries 1961-2000

<i>Explanatory variables</i>	Dependent variable: IMPORT GROWTH [m _i]		
	1	2	3
Lagged import growth [m _{t-1}]	0,1077 (2.04)**	0,1153 (2.18)**	0,0757 (1.43)
Domestic income growth [y]	2,4897 (12.11)***	2,3846 (11.92)***	2,4832 (12.34)***
Tariff change [t]	-0,0190 (0.53)	-0,0241 (0.67)	-0,0139 (0.40)
Relative price change [p]	0,2306 (2.47)***	0,2243 (2.41)**	0,2270 (2.49)**
Constant [c]	-0,0249 (2.32)**	-0,0208 (2.20)**	-0,0495 (3.66)***
Dillon-Kennedy Round dummy [dR ₂]		0,0025 (0.15)	
Tokyo Round dummy [dR ₃]			0,0531 (2.90)***
F-test	[0.0000]	[0.0000]	[0.0000]
R ²	0,55	0,55	0,57
No. countries/No. observations	9/178	9/178	9/178

Notes:

Figures in parentheses () are absolute t-ratios; figures in brackets [] are p-values. * indicates that a coefficient is significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

We also estimated the panel model considering the average *level* of tariffs, in place of variations (Pacheco-Lopez, 2005; Santos-Paulino and Thirlwall, 2004), in order to test these findings. The estimates broadly confirm the above results, and render them more robust. In particular, the effect of the trend in the average level of tariffs compared with the variation in imports is more significant in all the estimates, even though confirmed as not very relevant. It is interesting that in the case of the developing countries, there is a relatively greater effect on the average level of tariffs on trade, and a higher average level of tariffs with respect to those currently in force in more industrialised countries.

To conclude, the panel estimates demonstrate that the relationship between tariffs and trade, despite being confirmed empirically, appear to be less important and less significant in current trading relations. If the nature of international trade flows as changed over time (from inter-sectoral trade to mostly intra-sectoral trade), then this might have influenced the trade policies of partner countries, which currently are implemented through wide recourse to restrictive foreign trade measures of a non-tariff nature, rather than tariff barriers.

4.3. Final remarks on the empirical analysis

The results of the empirical analysis can be summarized as follows.

- The aggregate analysis confirms the existence of a long-run relationship between tariffs and trade. This relation is particularly relevant and significant in the period prior to World War II, when tariff liberalization was essentially linked to the post-Cobden Chevalier Treaty bilateral agreements and there was no a formalized system governing trade policy. From the 1950s onwards, tariff changes seem to have had significantly less effect on trade flow changes: in this period, the multilateral system seems to have generated a certain additional, albeit modest effect on the growth of world trade, compared to the previous regime. This effect was particularly relevant in the period of the Tokyo Round.
- The panel analysis confirms the findings from the aggregate analysis and highlights the relative greater significance in industrialized countries than developing countries of the relations between tariffs and trade.

5. Conclusions

In this paper we address the question of whether there is a defined and stable relationship over time between the reduction in tariff barriers and the growth in trade at world level in different eras, characterized by different trade regimes. We also investigated whether the current

multilateral trading system has been effective in promoting a liberalization process and the growing involvement of countries in world trade.

In terms of the first question, the empirical results based on a reconstruction of the historical trade and tariff data for the main trading countries for the 1871-2000 period, confirm the existence of a long-run relation at world level, between tariffs and trade. This empirical evidence is consistent with the theoretical literature which postulates the existence of an inverse relationship between tariff barriers and trade. Tariff liberalization, as emphasized by traditional trade theory and the more recent contributions in the literature, produces changes in relative prices which determine the shift in resources from the import-substitution goods sectors to the export goods sectors, leading to a better allocation of resources and thus increasing production and consumption. This relation, relevant and significant in the period pre World War II, gradually loses importance and significance after 1950.

In terms of the second question, the results obtained are partly in line with those in the empirical literature on this subject (Rose, 2004a; 2004b; 2005). The GATT/WTO international trading system operates in a historic moment when the relationship between the reduction in tariff barriers and trade growth was considerably weakened. This strengthens the arguments of those who suggest that the presence of a non-formalized trade regime, such as that in place before the current GATT/WTO multilateral system, is sufficient to determine the effects on growth of world trade through the reduction in tariff barriers. In the second half of the 1800s, Europe's economy experienced a positive phase, characterized by significant expansion in trade and economic development, due to technological progress but also to a general reduction in customs barriers throughout continental Europe, based on the wide network of bilateral trade agreements followed by the *Cobden-Chevalier Treaty* between France and the UK. On the other hand, it is fact that, from a historical perspective, substantial greater tariff liberalization was achieved only during the post-World War II period contemporaneously with the creation of a formalized trading system at the multilateral level. Greater tariff liberalization does not appear, however, to have

been the main cause of the extraordinary growth in trade flows that occurred in the post-World War II period. This highlights how the "GATT effect", the flywheel of trade, is linked not so much to tariff liberalization, as in earlier regimes, but to the ability to contribute to trade growth through the realization of a generally more conducive trade climate based on policies designed to ensure the rules and behaviours among the major players.

The diverse effects of the multilateral trading system among developing and industrialized countries emerging from the panel analysis, emphasize that, in concrete terms, the GATT/WTO system has favoured member countries that have participated actively in the management of the multilateral trade policy. For the regards developing countries, no meaningful relationship emerges between the reduction in tariff barriers and trade growth, and the relevance of accession to the GATT/WTO shows even less effect. This is in line with the conclusions of other authors (Hoekman and Kostecki, 2001; Rose, 2004b). Developing countries, whilst benefiting from significant exemptions from obligations deriving from accession to multilateral agreements, have not participated in the governing of trade policy on a multilateral basis, assured by the existence of a formalized system.

In summary, this study, confirming the long-run relation between trade liberalization and trade growth, highlights the importance of the presence of a formalized multilateral trading system with respect to an informal system based on a network of bilateral agreements, not so much in terms of the effectiveness of tariff liberalization, but rather in terms of the capacity to build a virtuous process of international coordination of trade policies and to ensure more comprehensive participation in world trade.

Appendix

Data definitions and sources

World Exports (X_w): the variable for world exports was obtained by aggregating annual export flow values by country (US\$, 1990 constant prices). Data for 1870-1950 come from the various official national documents, integrated with the work of Maddison (1989), Hofman (2000) and Mitchell (1998a; 1998b; 1998c). Data for 1951-2000 come from the International Monetary Fund *Direction of Trade Statistics* (DOTS).

World Income (Y_w): the variable for world income was obtained by aggregating annual income values by country (US\$, constant prices 1990) from the University of Groningen's *Growth and Development Centre* databank, integrated with the work of Maddison (1982; 1989; 1995; 2001).

World Prices (P_w): the variable for relative world prices is the ratio of the index of unit values of manufactured goods exported by a number of industrialized countries, and the price index of a representative basket of internationally traded non-fuel primary commodities.³⁰ These indices are from Grilli and Yang (1988), and are available for the period 1900-1986.

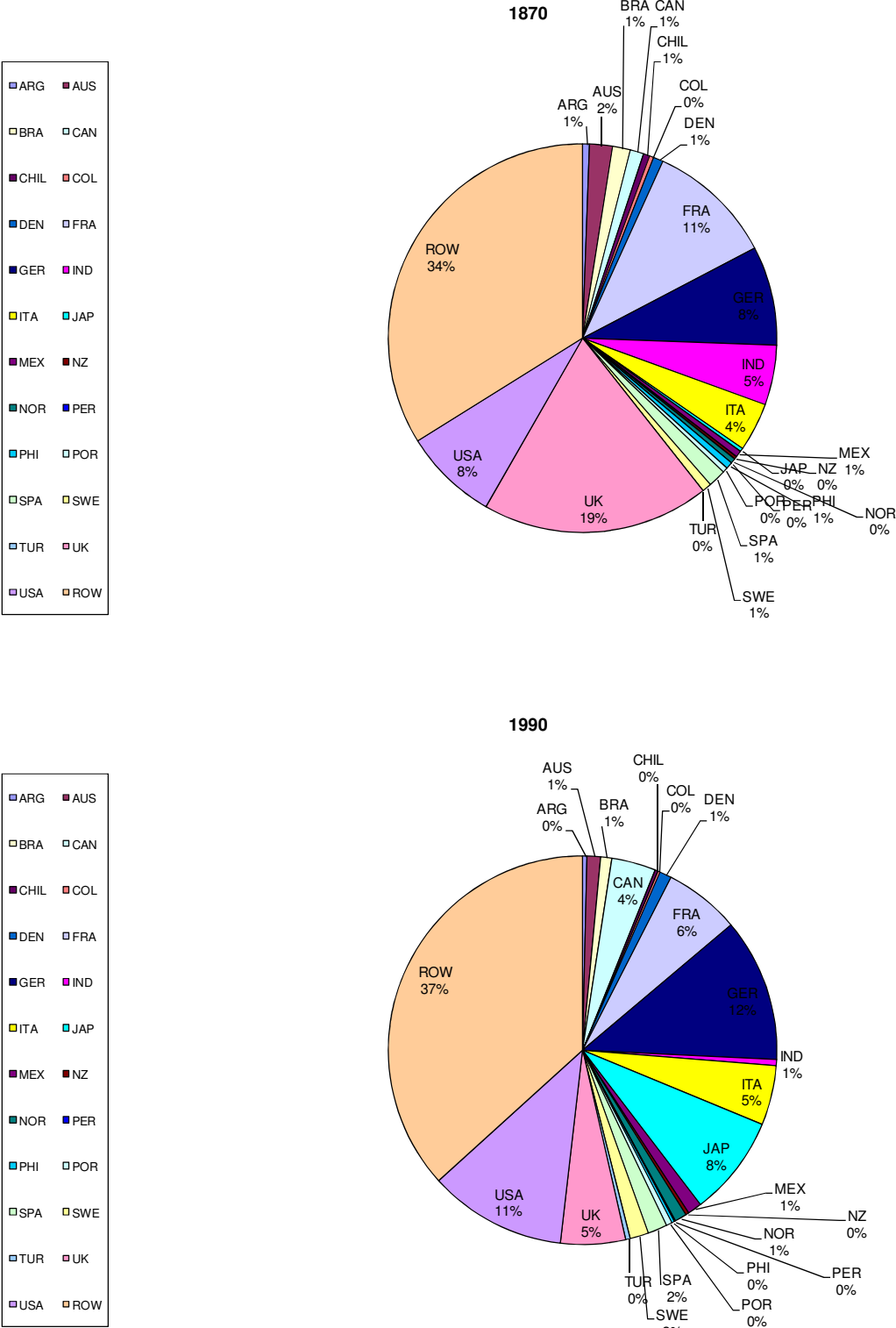
World Tariffs (T_w): the variable for world tariffs was obtained from the average of aggregate annual customs duties by country (calculated as the ratio between the import customs revenue and total imports value). The data on tariffs for 1870 to 1950 were drawn from the Harvard Research Group's databank, coordinated by Jeffrey Williamson. Data for 1950-1970 were derived from the work of Mitchell (1998a; 1998b; 1998c) integrated with official national documents; data for 1970-2000 are from the World Bank *World Development Indicators* (2002) databank. Although this measure may be considered rather rough, it continues to be the most commonly used variable in long-run analyses (see, e.g. Capie, 1994; Vamvakidis, 2002; Clemens and Williamson, 2001; O'Rourke, 2000, 2001). In our specific case, it is the only historical measure available for specification of the liberalization process observed.

³⁰ The index is weighted (the weights are the values of world exports of all goods relative to the 1977-1979 period).

Table A.1. – Countries analyzed

Countries	
Argentina	India
Australia	Italy
Brazil	Mexico
Canada	Norway
Chile	New Zeland
Colombia	Peru
Denmark	Portugal
Philippines	United Kingdom
France	Spain
Germany	Sweden
Japan	Turkey
	United States

Figure: A.1 – Share in world trade of the analyzed countries: 1870 and 1990 (percentage)



Source: Author's processing

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